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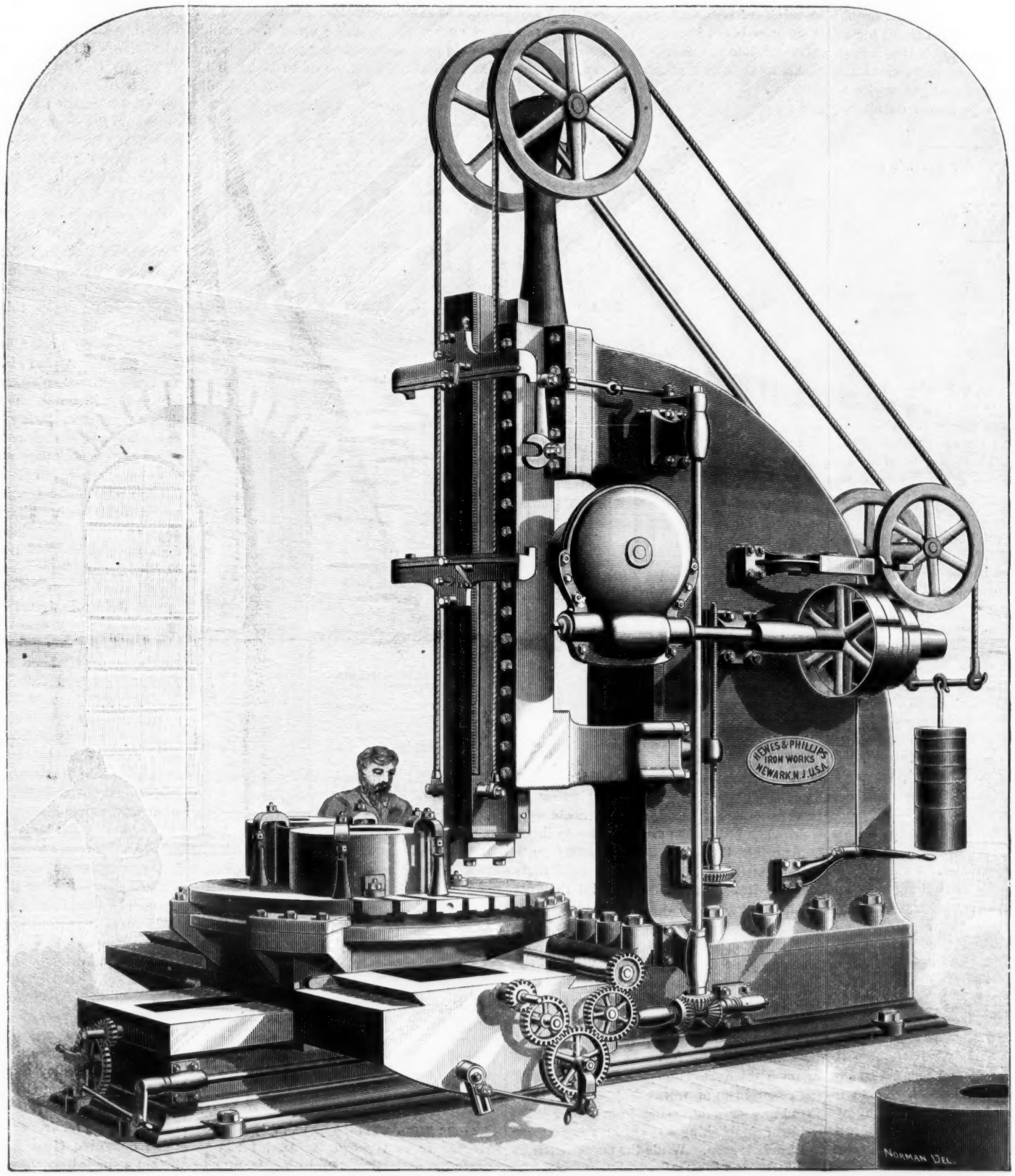


LARGE SLOTTING MACHINE MADE AT THE HEWES & PHILLIPS IRON WORKS.

Large Slotting Machine.

To meet the demand of the engineering public for ponderous and heavy machine tools, the Hewes & Phillips Iron Works, Newark, N. J., have designed a series of tools especially adapted for heavy forge, marine and railway equipment shops, the slotting machine illustrated in the cut being one of that number. This machine will take a piece of work, 54″ high, from the table, and will swing 12 feet diameter from the center of tool to face of upright. The cutter bar is moved by a V rack and pinion of steel, driven by their well-known worm gearing device. The machine is driven by 4½″ wide belts, separately shifted, having a speed of 130 to 1 of the tool. The weight of the bar is overbalanced, so that any back lash of gearing is avoided, the strain being always in the same direction. To avoid abrasion of the accurately-wrought surfaces of the bar and its attendant gibs, it is lubricated by an oil chamber on top of the bar, which oils the surfaces continuously, and in such a manner as to entirely exclude dirt and grit.

The stops or dogs for working the feed-shifting devices are attached to the tool bar, sliding in dovetailed groove in the center of its face, their size and weight necessitating their being worked by a rack and pinion on the side of the cutter bar. The feed is entirely independent of the shifting device, although worked from opposite ends of the same stop. The feed always takes place on the upper end of stroke, and requires a movement of only three inches of the bar. The reader will see that this is not an easy problem when the load to be moved may be twenty tons.

The cutter-bar guide has a vertical adjustment of 30″ to accommodate work of different heights. This is accomplished by means of two screws and cross-shaft within convenient working distance of the floor. The table is circular, and pierced with T slots. It has power movements in six directions, and can be changed at will without stopping

the cut, every movement of the feeding or shipping devices being within easy reach. The tool-holders for both inside and outside work are self-relieving on the upper stroke, avoiding the dragging of the cutting edge of tool over the work. When running a cut requiring the circular motion, the table can be clamped fast and solid at the front corner of the cross slide, securing it against the possibility of a change of angle, and relieving the circular gibbed surface from the strain that would otherwise come on it.

The belt shipper can be worked by hand from a lever on the side of the machine and in full view of the cutting tool, making it especially convenient in starting a cut or in setting a tool, the operator having a full view of every movement.

The frame of the machine is in two pieces, bolted together on the plane of the carriage; the upper frame is under-gibbed to the lower piece, and steel keys are driven in the back of the gib, so that to spring this joint it would have to tear off the tongue of metal six inches thick, extending entirely across the face of upper frame. The sliding surfaces of the carriages and tool-bar are at right angles to each other, so that the pressures on all surfaces are normal to those surfaces.

Revolving Core and Under Surface Sweeping.

By Thomas D. West.

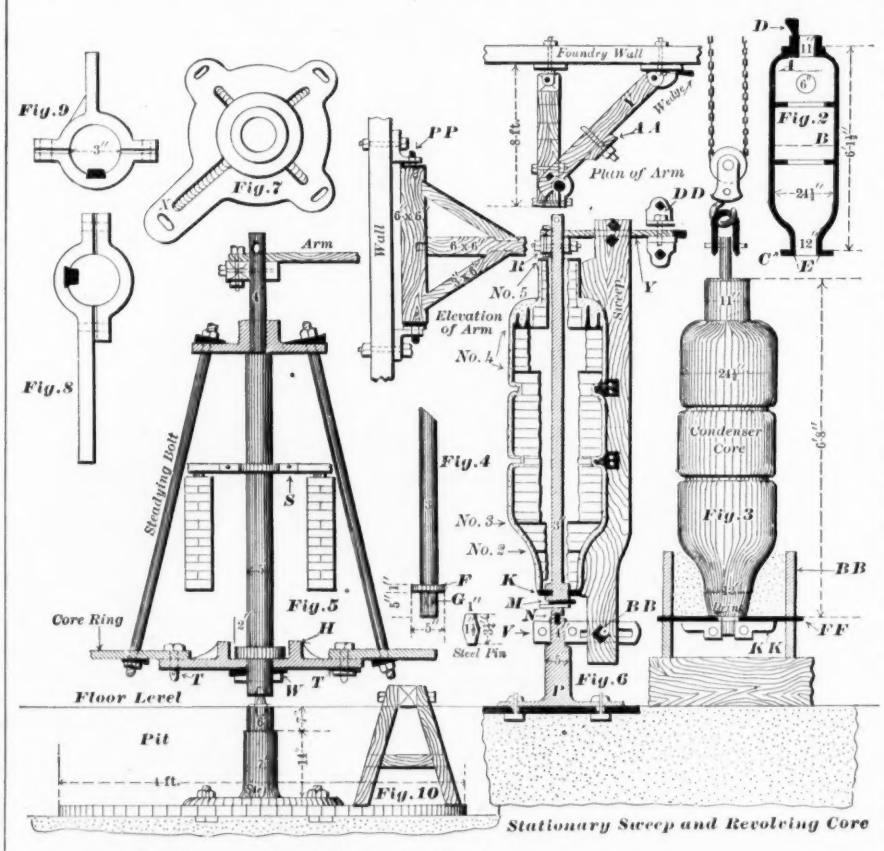
In the American Machinist of August 19, 1882, is an illustrated article upon "Sweeps and Spindles." The engraving shown is that of a rigging for under loam surface sweeping. Loam cores are often of such shape that some such rigging is almost indispensable. Having in our foundry a very simple arrangement, that is not only adapted to under sweeping, but to other purposes as well, and which is, in some respects, superior to the rigging previously shown, it is thought a description of its workings may be of value.

At the right is shown a condenser core, which practical loam moulders will concede to be rather a difficult core to make. Had the core been larger, the risks in making it would have been greatly lessened. The form of this casting is seen in the section, Fig. 2. The outside portion of mould was jointed in two parts at the respective heights *A* and *B*. The casting was run entirely from the bottom, the metal going in through two gates at the flange *C*. At *D*, upon the riser head, is a feeder. The situation of the gates will, of course, show that the mould was cast vertically. The six dots at *E* represent the print, which was swept in the mould for the print seen on core to set into. This guided and centered the bottom. The top was held centrally by three double-headed chaplets, placed in the riser head portion.

The advantage of the rigging here shown over the common run of spindles could seldom be better displayed than in making the core seen. The spindle is so designed that after the core is swept it is then hoisted by the same spindle, as shown in Fig. 3. This spindle having a collar *F*, and a key hole *G*, Fig. 4, provides for securing to it any plate or ring, as seen at *H* and *K*, Figs. 5 and 6. When the ring *K* is wedged up tight against the collar, by the keys *M*, the building foundation of the core is formed.

The steel pin *N*, being set in the step *P*, the spindle is then set up and secured by the top centering and holding arm *R*. This arm is so constructed that it can in no way be sprung. The elevation and plan view of arm show its construction in outline. After the spindle has been secured, the next operation is that of securing the sweep.

As a general thing loam cores are swept by having the sweep revolve. I doubt if there could be found six foundries in the United States that do not follow this practice. In fact, so far as I know, our shop is the only one that makes a practice of sweeping with stationary sweeps, as shown. The plan was established long before I ever saw the shop, and as I think it a good one, it is still used. The advantage of having the sweep stationary is, that the core is certain to come to whatever diameter the sweep is set to; also, there is no raising or lowering of spindle arms to clear the brick work as it is built up, as is necessary when the core is stationary and the sweep revolves. Having cores come larger or smaller than intended, or one end not right with the other in size, is no uncommon occurrence. Having to change the position of the arm, as is often necessary with revolving sweeps in sweeping long cores, one is apt to move the sweep, and as the brick work is more or less between the sweep and spindle there is no handy means of ascertaining it. We, of course, can caliper the core after it is swept up, but to then change the sweep's diameter is often objectionable, for loam scraped off or put on in thin layers may cause surface scabs. Some may say sweep only two small spots to test the diameter, then if found right sweep up the core. This, in many cases, is a good plan, and should be practiced when exact sizes are wanted. But as a general thing when a moulder sets the sweep he thinks of nothing but driving ahead, and if the core is not found to be the right size when set into the mould, he often can easily make himself and others believe that the pattern maker did not give the right sizes or gauges to set the sweep by.



In our shop all cores are calipered with long, wooden-legged calipers, simply to make sure that our gauges or measurements were right when setting the sweep to sweep them. Our president, J. F. Holloway, is very particular in knowing that all parts have the thickness the drawing calls for, and did they not come so, there would have to be an intelligent reason given.

Did the receivers of swept-up loam castings know how often the intended thickness is increased or decreased, in the castings they receive, they might be surprised. In loam work no one can, day in and day out, sweep all their moulds so as to measure to $\frac{1}{32}''$ of what the draft calls for. As little as $\frac{1}{16}''$ off or on a thickness is but a small matter with the general run of work; but when it comes to adding or subtracting from $\frac{1}{4}''$ to $\frac{1}{2}''$, the value of establishing ways of insuring correct thickness is seen. While the cores generally need the most attention, the outside part often requires measuring to insure correctness. A good plan to insure the thickness wanted, is to take the size of the first part swept upon a narrow stick when the mould is finished or blacked; then, when sweeping the second part, gauge the mould or core, as the case may be, by the measurement taken from the first part. By this means, if one does not get the first part the size called for, he has at least a chance to insure obtaining the proper thickness.

A third advantage the plan of sweeping shown has over the revolving sweep, is that the moulder can stand still, thereby saving labor and the making of a circus pedestrian of himself. A stranger to this plan would be surprised to see with what ease heavy cores can be revolved. Cores as large as nine feet in diameter and seven feet high have been swept here by revolving them. For heavy or high cores, there are two plans shown in Fig. 5, one of which it is sometimes found necessary to adopt in order to steady the core when being swept up with loam. One of these is to use steadying bolts, or swivel screws as shown. Three or four such bolts or screws may be used, running from the bottom ring up to a top-steadying flange, as shown. This is a good plan to adopt for cores of large diameter. The brick work seen inside of these bolts is to represent a high core being held steady by a top brace bolted to the spindle, as seen at *S*, and then wedged. Such braces are generally required when cores 18″ to 72″ diameter are longer than five to six feet. It should be remembered that the braces are not used during the bricking up of the mould, but only during the rubbing on of the loam. It keeps the core rigid, so as to assist in its being swept true. The size of the spindle given is that for cores ranging from four feet up to nine feet diameter. The spindle at Fig. 4 is for work under the above sizes.

The floor level and pit marked shows how we use the arrangement. A pit of the depth shown is very handy for our general run of work. The diameter of the pit being about ten feet, leaves room to walk around. The mud and bricks are kept on the floor, so that in first starting to build there is no stooping down to reach material. Then when the core is built two or three feet the pit is readily planked over to enable reaching up higher. Before removing the top arm for placing on plates or to hoist the core, it is necessary to have the under side of core blocked. For this purpose wooden horses come very handy. The one seen at Fig. 10 will be suggestive of how they may be placed. Fig. 7 is a plan view of *H*, Fig. 5. The long arm *X*, is attached simply to show that the same rig can be used for larger cores, by extending the lugs. It was by such a rigging the center core shown in my last article was made and lowered in the mould. When the core was trued by the set screws there described, the keys at *T*, *T*, were taken out, and after this those at *W*, which let the plate *H*, fall down to the bottom of the pit. The spindle now being released was hoisted out, and the hole in top of the core filled up. For this job the 3″ spindle was the one used.

For the condenser core, in setting the sweep, an arm is bolted to step *P*, as seen at *V*. (The cap of this arm is not shown in order to show the step and steel pin more fully.) This arm is set so as to be parallel with the top of sweep holding arm *Y*. The manner of bolting the sweep to this arm is more fully shown at *A*, *A*, in plan of arm. The bottom of sweep being secured by the bolt *B*, *B*, and the sweep found to be gauged right, all is then ready for building up the core, which is done as follows: Pieces of bricks being built up as high as No. 2, a thin cast iron ring is then laid on, after which the core is built up to No. 3, the plate there shown being then laid on; bricks are then built up, and the two plates at No. 4 being set, bricks are laid up to the end of the core, on top of which is a ring No 5. This is used for the purpose of blocking upon to hold down the core when casting. The inside of the core was filled with clean small cinders, lightly rammed, as it was built up. The core, being completed, was hoisted up and lowered on a plate *F*, *F*, Fig. 3. On this plate was set an iron ring *B*, *B*. This was packed with sand. The bottom of the spindle, where it projects through the plate *F*, *F*, was clasped by a cap having laps as seen at *K*, *K*. This being firmly bolted around the spindle the core was then hoisted and set on the oven carriage. While many may never have such a core to move, the plan shown will no doubt be worth remembering, for the principle is applicable to other work.

For sweeping up the outside moulds we use entirely straight spindles. In their ends is a hole so that they can be worked upon the same step as the spindles here shown. In sweeping these moulds the spindle and sweep revolve, the mould remaining stationary. In thick, straight spindles there is what some would call a key seat running the entire length. A plan of the arms which are used with these spindles is seen upon the left, at Figs. 8 and 9. The steel projections, shown in black, fitting into the spindle's key slot cause the arms to be exactly parallel to each other when two or more arms are used. This little wrinkle is one our president originated. We find it to save lots of labor in setting sweeps, and it also makes a certainty of obtaining true vertical lines that by the old method is hard to be reached.

Doing Justice to Inventors.

A beautiful memorial window has recently been erected in Newburn Church in the North of England in honor of William Hedley, by whose inventive genius the locomotive engine was first brought into successful operation as early as 1813. Those acquainted with the history of the locomotive will remember that William Hedley was the first to demonstrate that the popular belief, that a locomotive would exert no traction on the rails without the aid of a rack rail, was a fallacy. He constructed a successful working engine with smooth wheels, which worked hauling coal at Wylam for many years. It was this engine which George Stephenson borrowed the design from when he undertook to build his first locomotive. Stephenson, with characteristic egotism, on looking over Hedley's engine for the first time said that he could build a better one, but he never succeeded in keeping to his promise. We observe that European writers and public speakers are beginning to recognize Willam Hedley as the inventor of the locomotive, and not George Stephenson who has so often been erroneously honored as its inventor. So far from being the inventor of the locomotive George Stephenson did not invent a single important improvement about the engine. What he deserves the highest credit for was his persistent advocacy of railways and locomotives at a time when few Englishmen believed in the practicability of either.

Now, when the world is beginning to do justice to the memory of William Hedley, recognising him as the real inventor of a practicable locomotive, when are we on this side of the Atlantic going to do justice to the true inventor of the steamboat? There is nothing more certain than the fact, that John Fitch made the propulsion of boats by

steam a mechanical success before Fulton gave the subject any attention. Nine years before the Clermont was launched, John Fitch had a steamboat carrying passengers for the greater part of a summer on the Delaware river between Philadelphia and Trenton. Fitch sacrificed his life to the invention of the steamboat, his failures arising through want of financial and moral support. To the influence of Fitch's experiments in proving to the people what a steamboat could do, and educating them to accept the invention was to a great extent due the success of Fulton in the same line. Fulton received renown and riches for his enterprise connected with the introduction of the steamboat into popular use; we should not grudge poor John Fitch the empty honor of being its inventor.

Weaning Texas Railroad Men.

From a Texas paper we learn that the Texas Pacific Railroad Company are coming down hard on employes caught hanging about barrooms, and that several engineers in Marshall have been "fired out" for violating the order forbidding the practice of visiting saloons. The Texas journalist thinks the men will have to depend upon private bottles if they wish to hold their positions. We think they had better try and imitate the baby, and get along without the bottle. We are sure it would be better for all concerned if they would do so, and the Texas Pacific Railroad Company will certainly find that decrease of drinking and decrease of accidents will be proportional.

Crist's High-Speed Compound Vibrating Piston Engine.

The engraving presented herewith represents a high-speed compound vibrating piston engine, the invention of W. E. Crist, of New York City. As shown, it is connected direct to a high-speed exhaust fan, the arrangement being that employed by the Simonds Manufacturing Company, of New York, but the engine is calculated for use not only for direct connection to all classes of quick-running machinery, either vertically or horizontally arranged, but for use as a factory engine, or for any purposes where power is required.

It is very compact in construction, the two cylinders, as well as the pistons, being in one piece, the steam being first worked in the upper or high-pressure part and then exhausted directly into the lower or low-pressure part, acting against both sides of each piston. Two balanced valves, driven by a single eccentric, are used for admitting and exhausting the steam, the arrangement being such that steam is cut off in both cylinders, and that the desired amount of compression to insure economy and smooth running is obtained. The cylinders are both steam jacketed, and covered by a single head at each end.

A vibrating arm is keyed fast to the pistons, from which motion is communicated direct to the crank through the connecting-rod, without the intervention of crosshead or slides. The crank-shaft is of steel, and the crank-pin of steel, hardened, all wearing parts being made interchangeable. The boxes are of babbitt metal, cast in a mould, being of circular form, and split for taking up the wear. The pistons are packed with metallic packing, fitted with springs to compensate for wear. There being no piston-rod or similar parts, and all joints being scraped, metal to metal, no fibrous packing is required in any part of the engine.

The low-pressure cylinder of this engine may exhaust direct into the atmosphere or into a condenser. It is claimed for this engine that it may be run at any desired speed; that it can be located in situations where it is not practicable to build a foundation, as in the upper stories of building, and that the few parts reduce the loss from friction to a minimum, and hence that it is very economical in the use of steam.

The manufacturers are the Crist Engine and Machine Company, New York City.

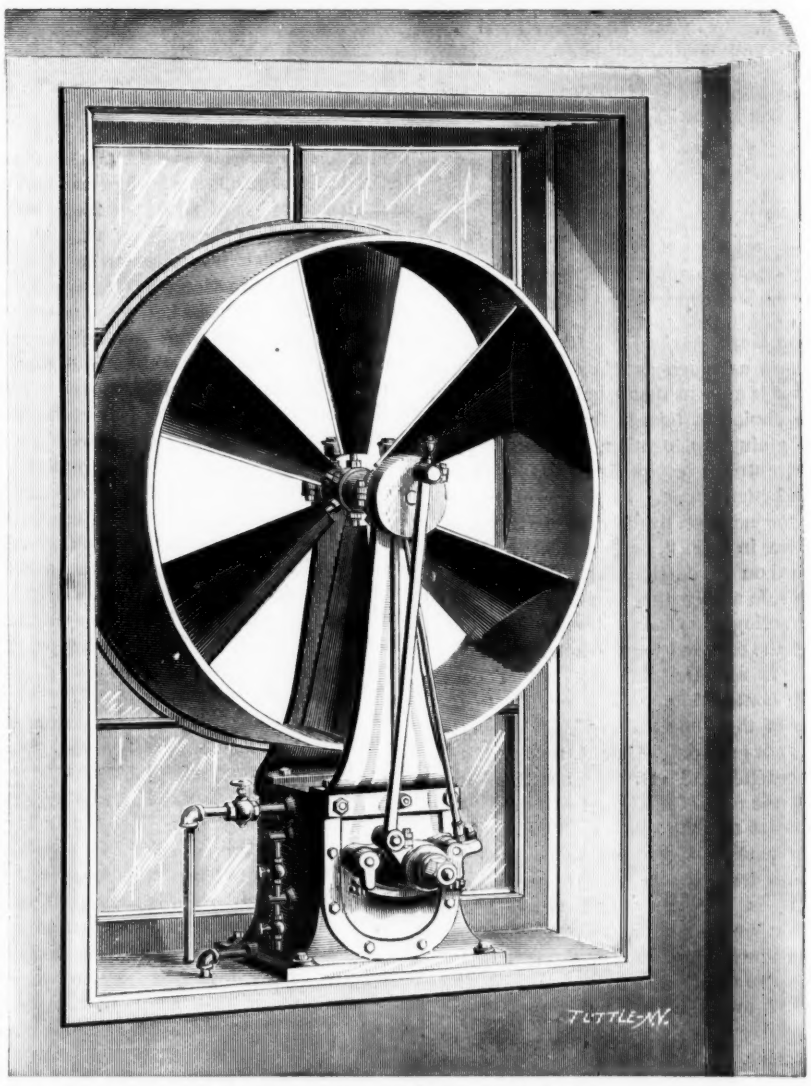
The engines are built at the shop of E. E. Garvin & Co., 139 and 141 Centre Street, under the supervision of Mr. Crist.

Locomotive Engine Running—Valve Motion.

By Angus Sinclair.

WHAT HAPPENS INSIDE THE CYLINDERS WHEN AN ENGINE IS REVERSED.

Many men who have a fair understanding of the action of steam in an engine's cylinders during ordinary working have no idea of the operations performed in the cylinders when a locomotive is running in reverse motion. All men who have had anything to do with train service know that when an engine is reversed the action works to stop the train, even if the locomotive should have no steam on the boiler; but just in what way this result comes round they cannot clearly perceive. In hopes of throwing light upon the subject for those who have not studied it out, we will follow the events of a stroke in reversed motion, as we did in the ordinary working.



Crist's Compound Vibrating Engine.

EVENTS OF THE STROKE IN REVERSED MOTION.

Supposing an engine to be running ahead, and the necessity arises for stopping suddenly, and the reverse lever is pulled into the back notch. When the crank pin is on the forward center, and therefore the piston at the forward end of the cylinder, about to begin its backward stroke, the valve has the forward port open a distance equal to the amount of lead. But as the back-up eccentric has control of the valve, the latter is being pushed forward, and it closes the forward port just as the piston begins to move back. This shuts off all communication with the forward end of the cylinder, and the receding piston creates a vacuum behind it, just as a pump plunger does under similar circumstances. At this time the back end of the cylinder is open to the exhaust, and the piston pushes out the air freely to the atmosphere. By the time the piston travels about two inches, the valve gets to its middle position, and immediately after passing that point it opens the forward end of the cylinder to the exhaust and closes the back port. When this event happens, the vacuum in the forward end of the cylinder gets filled with hot gases that rush in from the smoke-box, and the receding piston keeps drawing air into the cylinder in this way during the remainder of the stroke, and air from that quarter seldom gets in without bringing a sprinkling of cinders. The back steam port is closed only during about two inches of the stroke, while the lap of the valve is traveling over it. About the time the piston reaches four inches of its travel, the back steam port is open to the steam chest, and the piston forces the air through the steam pipes into the boiler during the remainder of the stroke. The forward stroke is merely a repetition of the backward stroke described.

When it is necessary to reverse a locomotive, it is a better plan to hook the lever clear back than to have it a notch or two past the center, as some men persist in doing, under the mistaken belief that they are in some way saving their engine from harsh usage. When the link is reversed full, the cylinders are merely turned into air pumps. When the links are put near the center, the travel of the valve is reduced, and the periods when the piston is creating a vacuum in one end of the cylinder and compressing the air in the other are prolonged. The result is that, when the exhaust is opened in the first case, the gases rush in violently from the smoke-box, carrying a heavy load of cinders; in the other case, the piston compresses the air in the cylinder so high that it jerks the valve away from its seat in trying to find outlet. This causes the clattering noise in the steam chest, so well known in cases where engines are run without steam while the reverse lever is near the center.

A locomotive with the piston packing in bad order will not hold well running in reverse motion. Some kinds of piston packing do not seem to act properly when the engine is reversed, especially at low speed. Where a valve has much inside lap, there will be a vacuum in one end of the cylinder and compressed air in the other end. With piston packing that requires pressure to expand it, the void at one end of the cylinder may neutralize the pressure at the other by drawing the air through the piston. This would be most liable to happen where the lever was kept near the center.

PURPOSE OF RELIEF VALVE ON DRY PIPE.

Should the throttle valve close so tight that the compressed air from the cylinders cannot pass into the boiler, there is danger of bursting the steam chest or some part of the steam pipes. The compressed air will lift most of the throttle valves far enough to prevent any great danger from this source. In some engines a relief valve is secured in the dry pipe, which provides a passage for this compressed air. When the cylinder cocks of an engine are opened when the motion is reversed, they form an outlet to the compressed air, and also admit air to the sucking end without letting the piston draw air so freely through the nozzles. Many cylinder cocks are now made so that they will open automatically to permit the piston to draw air through them. The reversed engine will stop nearly as well with the cylinder cocks opened as when they are closed, and she is much more easily handled with the cocks opened. Where the cocks are kept closed, the rush of hot air from the smoke-box laps every trace of oil from the valve seat, and a heavy pressure—frequently above that of the boiler—is present in the steam chest. When the engine stops under these circumstances, its tendency is to fly back, and an engineer has some difficulty in controlling it with the reverse lever till a few turns empty the chest and pipes.

USING REVERSE MOTION AS A BRAKE.

Numerous attempts have been made to utilize the reversed engine as a brake for stopping the train, and even by this means to save some of the power lost in stopping. Chatelier, a French engineer, experimented for many years on this mechanical problem. He injected a jet of water into the exhaust pipe, which supplied low-tension steam to the cylinder, instead of hot gas or air coming through the smoke-box. This was pumped back into the boiler on the return stroke. Thus the act of stopping a train was used to compress a quantity of steam, converting the work of stopping into heat, which was forced into the boiler and retained to aid in getting the train into speed again. Modifications of this idea produce the car-starters that pass so frequently through our Patent Office.

As a means of conserving mechanical energy, the Chatelier brake was not a success, but, in the absence of better power brakes, it met with some applications in Europe. Some of our mountain railroads use it, under the name of the water brake, as an auxiliary to the automatic brake.

A new lubricating compound has just been patented by Buel F. Bartlett, Dunkirk, N. Y. It consists of a mixture of graphite, dairy salt, flour of sulphur and gypsum put together in certain proportions.

Mr. James Brady, head of the Brady Manufacturing Company, 257 Water Street, Brooklyn, has carried on an evening class during the winter for the mental improvement of his workmen. It was specially intended for the benefit of the apprentices connected with the works, but the older hands were not excluded, and several of the oldest men in the works attended the classes and took part in the studies. Mr. Brady was highly gratified with the interest manifested in the school by all concerned, and he intends extending its operations next season.

Good Resolutions.

A locomotive engineer, who promises to write us some short articles on locomotive subjects, sends a copy of the following resolutions which he noted on his first time-book when first promoted to the right-hand side. We wish all young engineers would learn the resolutions and endeavor to keep them:

TEN RESOLUTIONS.

Whereas, having this day been promoted from the rank of fireman to that of locomotive engineer, and knowing that I thereby virtually take in my own hands many human lives and millions of property, be it

Resolved, that I will *never*, so long as so employed, taste one drop of intoxicating liquor, to muddle my brains.

That I will never, while so employed, visit a house of prostitution, a gambling house, dance house, or any place of debauchery that will rob me of any rest whatsoever.

That I will never knowingly disobey orders.

That I will never make out a false report to save any man's job, mine included.

That I will never join a strike, except in the most aggravated case, and not then until arbitration has been tried more than once.

That I will never believe I have learned it all, but always try to learn from those below me as well as above.

That the Golden Rule shall be my railroad religion.

That I will never strike stock if I can stop and avoid it.

That I will always spend at least $15 per year for useful mechanical reading.

That I will never refuse to tell a fireman all I can of the business, if he asks it.

Gillcrank.

Material for Patterns.

By Isaac Whitehead.

In choosing material for a pattern we must take the following points into consideration, in the order named:

1st. Its quality to keep its shape when formed.

2d. Its strength to withstand the strains of rapping, and the general usage of a foundry.

3d. Its ease of manipulation, and cheapness.

Deal and pine are generally chosen as filling these conditions the best for general work, but where extra strength is required because of the delicacy of the pattern, or the great number of castings required of it, either mahogany or cherry is chosen. In small standard patterns, iron or brass is used, first making a pattern of pine. I lately saw a whole set of gasoline stove plate patterns made of brass and finished, when it was discovered, that they must be thrown aside and iron patterns made because brass was not stiff enough to keep its shape under the general usage of the foundry. Small stiff patterns are best made of brass and also their gates, because the surface keeps smoother than iron, and the joints are easily soldered. In selecting wood for patterns it requires to be straight grained, well seasoned and free from knots or shakes. Choose the soft, yellow, close-grained, and light wood, slightly resinous, rather than the dry, hard nut-brown fiber with the grain strongly defined. The former withstands the action of the temperature and moisture of the atmosphere better than the latter, and so is less liable to warp or change its outline.

According to experiments made by M. Lepley, "green wood, when cut down, contains about 45 per cent. of its weight in moisture. Wood cut down in winter holds at the end of the following summer more than 40 per cent. of water. Wood kept for several years in a dry place retains from 15 to 20 per cent. of water. Wood that has been thoroughly kiln dried, will, when exposed to the air under ordinary circumstances, absorb 5 per cent. of water in the first three days, and will continue to absorb until it reaches from 14 to 15 per cent., the amount fluctuating above or below this standard according to the state of the atmosphere."

These statements are closely verified by other experimenters. If we assume that by the same ratio the wood will absorb moisture so it will expand (which I think is correct), then it will be evident from the above statements that wood however dry is still subject to change, and that even kiln dried lumber requires to be stacked in a dry place until it settles to the natural conditions of seasoned lumber.

To season lumber for pattern work, it should be stacked where it will receive a free circulation of air. It is better if it has an extemporized roof to protect it from the sun and rain. A stack formed by a ridge pole, and the boards set on end clear of the earth and under cover, but well ventilated, is, I think, the best. In storing lumber in the shop make three stands framed up in square pockets ranging from the floor to the ceiling, and from 16″ to 24″ high by 16″ wide. The boards are set in on their edge the thick and heavy planks on the floor, or lower pockets.

It will take four years to season wood sufficiently to be fit for general pattern work. For special and particular work a careful pattern maker will generally have a store of wood 20 or 30 years old, that is in good preservation and had perhaps been previously used in an old pattern or building and by thoughtless persons would have been thrown away.

Straight-grained pine will not shrink endwise perceptibly, but across the grain it is always liable, however dry, to swell and shrink to some extent, according to the humidity of the atmosphere. For this reason wood should not be glued together with the grain of one piece crossways to the other. The sap wood or outer part of the tree will shrink more than the heart, hence a whole tree will always split in drying, as shown at *S*, Fig. 1. In experimenting with two boards cut from the same log, one from the position *A*, *B*, *C*, Fig. 1, and the other from *E*, *D*, it was found that the board *A*, *B*, *C*, contracted $3\frac{3}{4}$ per cent. in width, and became hollow at *B*. The board *E*, *D*, kept straight and contracted but $\frac{7}{10}$ per cent.,

Fig. 1

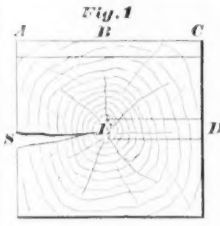
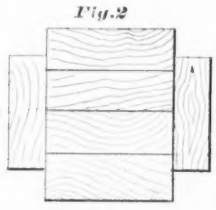


Fig. 2



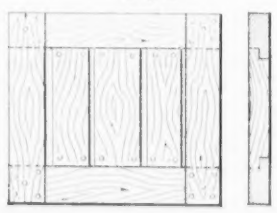
showing that the board *A*, *B*, *C*, contracted five times as much as *E*, *D*. From these results it is evident that particular attention in the choice of boards for certain work, and in gluing up together, is necessary, so that their strains be equalized and so tend to keep in better shape. In gluing up a solid block, for instance, by distributing the grain, as shown in Fig. 2, with the heart side of the board on the outside, then the pores on the sap side are by this means closed, thus counteracting the strains, besides the tendency of the exposed joint to keep closed.

There is another difficulty in this condition of contraction, which relates to the curving of the wood lengthwise. When the grain is not perfectly straight, that is if the tree is crooked and a straight board is sawn from it, one part of the board will take more of the heart than the other. The result is the sap part will contract more than the other, and draw the board crooked lengthwise. It is this curly and cross-grained board that we hear of contracting endwise, as far as I have observed.

In constructing patterns the fact should always be taken into account that wood however dry is subject to this change to some extent. I have seen well seasoned wood vary at the rate of one-tenth of an inch to the foot in width between the temperature of the pattern shop and foundry. I have made patterns that have been correct the first day of casting, but became too large subsequently. The neglect of not making proper allowance, or of not considering this point in the construction of a pattern, is a common source of great trouble and bad work. Too much importance cannot be laid upon this consideration, as it arises in almost every description of pattern that is made.

The best, cheapest and most effective way to meet this difficulty is by framing and using the wood lengthwise of the grain in construction to keep up the essential sizes or outline of the pattern, and by using open joints in all plates, so as to allow the wood to be free to come and go, and yet not affect

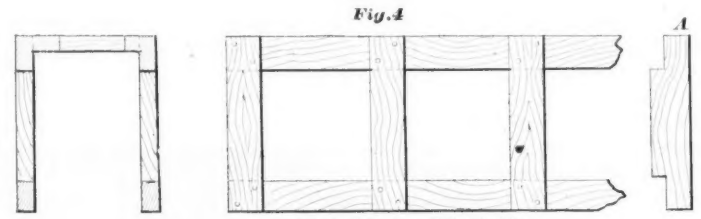
Fig. 3



the essential sizes. To illustrate this principle, take a plate pattern, Fig. 3, which is framed together, by half lapping the corners and screwed. It is evident that the outline will always keep its size. When the center is filled in, the boards should be laid upon a rabbit and screwed at each end, first sawing the boards through the heart to about 6″ or 8″ wide, and the joints $\frac{1}{8}$″ apart. The same principle is carried out sometimes without framing, by securing the boards together with ribs or battens, which are stopped off in the sand, but the precaution is still needed to leave open joints as before.

In the patterns of the large girder frames used in the engines of our Atlantic steamers the deep flanges are formed entirely by framing $2\frac{1}{2}$″ or 3″ wide, and the thickness the same that the metal is required, on the principle as shown in Fig. 4. The frame is bedded in the sand, the inside rammed up, and struck off level with the frame on the outside; the sides are cheeked off, and then the panels struck out with strike *A* to the thickness. I have seen this plan adopted in core boxes for steam-jacketed cylinders, for condensers and large work generally in large marine engine shops with good results, especially in avoiding trouble from shrinkage of timber. The half lapping in such framing is carefully screwed, and clearance allowed on the side joints, so that when the lap swells in the sand it will not press against its side and throw the line of framing crooked.

Fig. 4



Shrinkage and Suitable Construction of Wood

Another advantage may be gained over this difficulty in shrinkage by first sawing out all your pieces to about the sizes required for the pattern; then laying them around so that the air has a free circulation about them. They will then be more likely to settle down to their new strains, created by their new shape, by the time you are ready to shape them to their finished sizes.

So far I have endeavored to show how best to avoid the evil. Now I will consider how best to remedy it when it presents itself in a finished pattern. This is sometimes impossible, and is always more difficult than its prevention would have been. When it occurs in the plate or web of a pattern, make a few saw cuts through the plate; hold it in shape with battens if necessary, thus creating open joints. This is generally the best way. When it occurs lengthwise of the grain cross-cutting the grain on the hollow side in several places, sufficient to bend the stick back by driving wedges in the saw grooves, is a plan generally adopted.

The majority of men who make patterns follow the cabinet-maker's style, and without considering their requirements or usage in the foundry take pride in making close joints with nails and glue, so that the pattern looks well in the pattern shop, but it often plays havoc with the mould.

It is not sufficient that a pattern is right when it leaves the pattern shop; it must be so constructed that it will keep right under the conditions to which it is subjected in the foundry.

As we enter into larger and heavier work, these points call for greater attention. For metal patterns cast-iron is used in the larger and heavier class, which are not often fitted up with gates in a "card" or "spray." It is more difficult to join iron patterns to gates, as they will not easily solder, and therefore require to be lapped and riveted together. A white metal is very generally used, consisting of two parts lead and one of tin, and is very easy to work. For brass a pure mixture of copper and tin is considered the best.

Traffic and earnings of Northwestern railroads are, thus far, not so good as last year.

Crosby Safe Water Gauge.

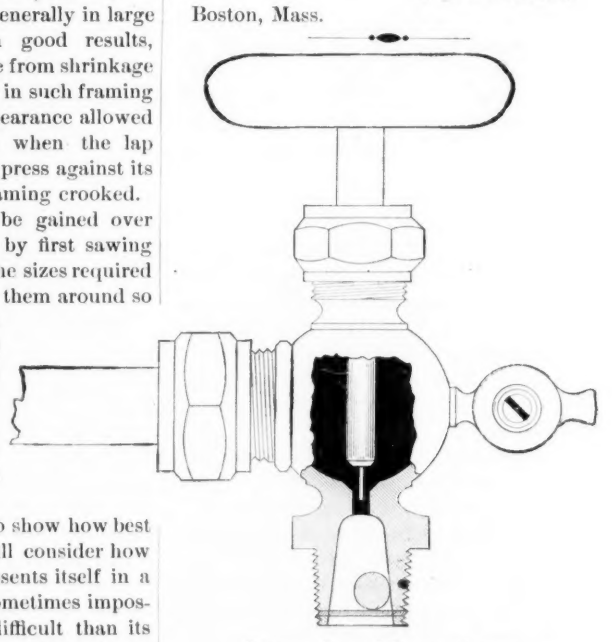
Editor American Machinist:

In an article in No. 11, vol. 7, of your valuable paper, dated March 15, 1884, headed "The Player Water Glass Cock," the author, after enumerating the advantages derived from the use of the device shown and described, states: "It was invented by John Player, mechanical engineer of the road," (N. Y. West Shore and Buffalo Railway) "but is not patened, so any master mechanic or boiler user can adopt this form of water-glass cock without being called on to pay royalty."

To correct this statement and prevent master mechanics, boiler users, or any other person or parties from infringing unwittingly, I wish to state that the device alluded to was patented several years ago, and is owned and manufactured exclusively by the Crosby Steam Gage and Valve Company, of Boston, Mass. See engraving herewith.

Geo. H. Crosby.

Boston, Mass.



Crosby Safe Water Gauge.

LETTERS FROM PRACTICAL MEN.

Charging Cupolas and Melting Iron.

Editor American Machinist:

I noticed an article on melting, by W. A. P., in American Machinist, March 22, and in reply would say that the melter, or whoever has charge of the cupola, does not understand charging a cupola of that size. I am using a cupola the very same size, and I melt from three to five tons a day. At the present time I am melting 7,000 pounds a day, and all the coal I use on the bed is 600 pounds. On this I charge 1,500 pounds of iron; then I use 200 pounds of coke, and charge 1,000 of iron. After that I charge 500 of iron at a charge, and put on 100 of coke, and so on until I have 5,000 of iron charged. The last 2,000 I make the bed that is in melt.

Now, I would say, for the information of W. A. P., that if the melter will put 500 of hard coal on the bed, and about the time the cupola is ready to charge, put on 100 of coke, so as to make his bed level, and the iron will not drop too near the tuyeres, he will get hot iron, and get it faster. He can charge 1,500 of iron on this bed, after which put on 100 pounds of coke, and that will melt his 2,600 of iron, and will be too much fuel for that amount of iron.

I quite agree with W. A. P. in regard to the size of pipe. Eight inches would be large enough, and tuyeres 2″x10″ would be ample. The trouble is the blast is too soft, and does not give pressure enough. I should

say to the owners of this foundry, if you only melt from 1,500 to 3,000 lbs. a day, get a cupola about 25″ in diameter, and use a No. 4 blower. It will pay for itself in six months, I used to melt 2,500 of iron in a cupola in Boston, Mass., with only 400 of coal, with a boy as a melter. Last March I melted 7½ tons twice a day, making 15 tons a day, in a cupola only 32″ in diameter, using a No. 5 blower, and melting at the rate of three tons per hour.

The greatest trouble in foundries is that most of the foremen are not practical melters, and in a great many foundries there is no attention paid to melting iron for strength; a thing that is of great importance.

DAVID SPENCE,
Foreman for G. W. Brown & Co., Galesburg, Ill.

What is Centrifugal Force?

Editor American Machinist:

Mr. Porter, in his instructive articles, in your issues of 16th and 23d ult., on "The Bursting Strain in Revolving Wheels," objects to the definition given by "The Civil Engineer's Pocket-Book" of centrifugal force, as "that with which a body while revolving around a center tends to fly off in a radius," on the ground "that it is not true:" and he further disputes the propriety of the term "centrifugal force" on the ground that what is usually so-called "is not centrifugal, and is not a force."

Happily Mr. Porter makes amends for the unorthodoxy of the remark last quoted, by hastening to state, in effect, that it *is* "centrifugal" and *is* "a force." For he speaks of "the force drawing the body towards the center," and says "the body resists this deflection," and "this resistance is necessarily in the opposite direction;" *i. e. centrifugal.* That a resistance is a "force" goes without saying.

Not only this, but Mr. Porter, after giving the usual rule (the same as given by the "Pocket-Book") for the *amount* of this centrifugal force, goes on to say, "this force is exerted to burst a wheel of uniform section, in the same manner precisely in which the force of steam is exerted to burst a cylindrical boiler." Surely no one need be told that the steam exerts a "centrifugal force," and that it "tends to fly off in a radius."

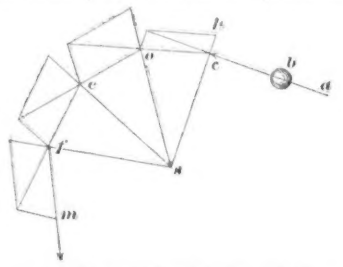
Mr. Porter thus demonstrates so clearly the correctness of his view of this "force," and of its "centrifugal" tendency, that it is hard to see why he objects to its being called by its right name.

His claim that "the body has no tendency 'to fly off in a radius,' but only to proceed peaceably on its way," might, at first sight, appear to be well founded, if (using an apple tied to a string as an illustration) we regard the *string* as *acting* only, and the *apple* as *resisting* only; but it must be remembered that just as truly as the string strives to deflect the apple from a tangent, just so truly does the apple (in trying "to proceed peaceably on its way") strive to pull the string over to that tangent; in other words, the body *has* a *tendency* (while the string holds) "to fly off in a radius," which is the only line in which strain can be applied to a string or rod, free to move about a center.

But Mr. Porter asks, in effect, "if the body has that tendency, why does it not follow it when the string breaks?" Because the tendency ceases with the breaking of the string, and the apple, no longer required—no longer *able*—to exert a *radial* tendency, obeys the only remaining force acting upon it, viz., the tangential force.

The centrifugal force of the apple, and the centripetal force exerted at any moment through the string, while it holds, are equal to each other, and these two equal forces, pulling in opposite directions at the two ends of the string, produce a strain on the material of the string equal in amount to one of them, as explained on page 445 of the "Pocket Book." If the velocity is increased, these two forces increase together until a point is reached where the strain equals the tensile strength of the string, which, up to this point, has been in constantly decreasing excess of the requirements upon it. The moment this point is passed the string falls asunder, the centripetal and centrifugal forces cease at the same moment, and, as remarked above, the apple moves forward in a tangent, impelled by the only remaining force.

To make this clearer, imagine a billiard-ball, *b*, moving in a straight line, *a c*. At *c* it is struck by a cue moving toward *s*, with a force *h c*, and the ball now moves forward to *o*, where it is struck by a second cue (moving toward *s* also) and travels to *e*, and so on.



Now, on *reaching* each of those points, *c*, *o*, *e*, etc., its tendency is tangential (or would be if the number of points were infinite, as in a circle). It wants to proceed peaceably in its direct, tangential path; but on meeting the first cue, *c*, this tendency is interfered with. There can be no peace; there must be war. The tangential tendency becomes decomposed into (1st) a *new* tangential tendency, *c*, *o*, and (2d) a tendency, *c*, *h*, "to fly off in a radius," *s*, *c*. The cue prevents the ball from following the latter. The former carries it on to the next cue, *o*.

In the case of the apple and string, or in that of the revolving fly-wheel; the string, or the cohesion of the rim, acts as a continuous "cue," or circular guide, and each point in the circumference of the circle described, is a point of resolution of forces, where an old tangential tendency is resolved into a new tangential, and a centrifugal one, the latter counteracted by the tensile strength of the string, or of the rim; the former urging the apple, or portion of rim, forward to the next point.

Now, when the string, or the rim, breaks, or when the billiard-ball passes the last cue, *f*, there is plainly nothing to bring about a resolution of the tangential force, *f*, *m*, consequently there can *then* be no further "tendency to fly off at a radius," and the body *then* "proceeds *peaceably* on its way."

As this seems to be a question of *definitions* merely, I may be permitted to remark that if the above explanation is sound, Mr. Porter is inaccurate in saying "centrifugal force may then be properly defined . . . as the tendency of a moving body to move in a direct line," meaning a tangential line. The centrifugal force is merely a *component* of this tangential tendency. The remaining component carries the body forward to the next point of resolution, which point, in a circle, is infinitely near.

Philadelphia, Pa. JOHN C. TRAUTWINE, JR.

1st. It is easier forged, and galls do not occur in the corners, as is frequently the case in the old style.

2d. They can be more cheaply fitted up with any machine as ordinarily used in locomotive repair shops, as any number of pieces can be placed side by side on planer and worked together.

3d. There is no excuse for brasses wearing away the straps, as they can be firmly *clamped.*

4th. They can be put in place or removed much more quickly than the old style.

At some future time I may send you a sketch of a *solid end* rod and brass, which may at least suggest something desirable in that direction.

J. D. HOLLISTER,
Superintendent Florida Southern Railway.

Eastern Demand for Western Men and Western Demand for Eastern Men.

Editor American Machinist:

Not long ago some mention was made in the AMERICAN MACHINIST regarding the relative demand for workmen, as between the East and the West. I have a "straw" as politicians say, which may be of interest.

In 1860 a man in the eastern part of Massachusetts advertised in a popular mechanical paper of the day for a position of responsibility in a machine shop. He got a number of replies, all from the West, and six of them west of the Alleghany mountains. In 1883 a man in Chicago advertised in the AMERICAN MACHINIST for a position of responsibility in a machine shop, and he got still more replies, all from the East, the majority of them east of the Alleghany mountains, and several from Massachusetts.

Q. K.

Cincinnati, O.

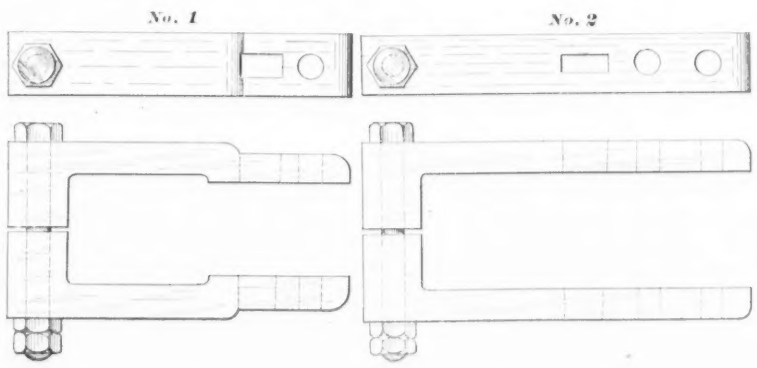
Stretching Boiler Tubes.

Editor American Machinist:

I note in your issue of March 22 an article headed "Stretching Short Boiler Flues." I do not think the theory advanced by H. F. N. is either good or practicable. If, as he says, the flues were so short that they almost dropped inside the head, they would have to "stretch" from one-half to three-quarters of an inch in order to be long enough to bead them on the outside of the head. It seems incredible that a flue would stretch that distance by inserting a red-hot bar in one end of it. I would be pleased to have H. F. N. explain the matter more fully, give length of the tubes, thickness of the head, and state to about what temperature the tubes were heated.

If, however, his theory is practicable, did it not show poor judgment and management on the part of his foreman in having them come too short? and would it not be rather expensive having the workmen standing idle while the "Boss" was stretching the flues by means of the hot iron rod? If this practice is carried on to any considerale extent, it may explain the cause of so many accidents and delays caused by the bursting of flues.

J. E. M.



Improved Rod Ends.

Editor American Machinist:

About two years ago the crank-shaft of a double pile-driving engine used by us broke through both wrists. The body of the shaft was 3½″ diameter and the wrists only 2½″; hence the breakage. I had wrists of new shafts made 3½″, and, to save making new rod ends, adopted the expedient of making straps as indicated in Fig. 1. It then occurred to me that there were sufficient good points in the device to justify the trial of it in regular locomotive work.

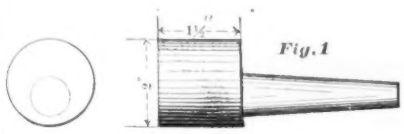
Having now given it a thorough trial on locomotives in general service, I am fully satisfied of its superiority over the old style of solid forged strap, for the following reasons:

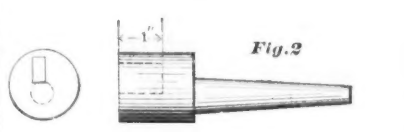
Lathe Attachment for Cutting Tapers.

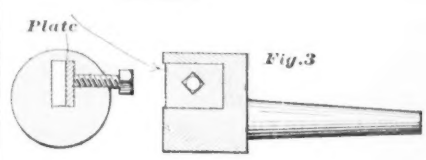
Editor American Machinist:

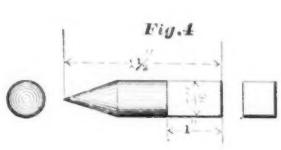
Please allow me to send you the following, which I think will be appreciated by a certain class of machinists:

Those having foot lathes or small power lathes, in which there is no provision made for cutting tapers—that is, the lathe is not furnished with tailstock to be set over, neither is it furnished with compound rest—will find the following device useful: Have a tailstock center made, as in Fig. 1. Make

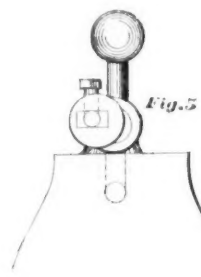


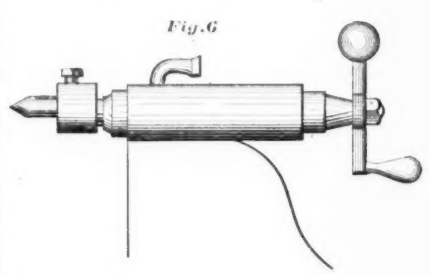






large end by dimensions. The end for tailstock spindle is, of course, fitted to lathe. Now cut a slot in face of large end, 1″ long, 1″ deep and ¼″ wide, as in Fig. 2. This slot may be cut by drilling two ¼″ holes 1″ deep, filing out the iron left between holes and squaring up the corners. Now make a plate of steel or iron, 1″x1″x$\frac{1}{16}$″, and set it in slot. Have a hole drilled (about ¼″) in large end of center, so that it will come through into slot, tap it and make a set





screw to correspond. After plate is inserted, and set screw screwed in, a section through section line of center will be as in Fig. 3. Next have a spindle turned as in Fig. 4, the pointed end round, the other end square as in cut, made by dimensions given. Now fit spindle in center between plate and metal, and drive the center in tailstock spindle, with slot horizontal with lathe-bed and set screw standing vertically. Drive in tight, so that it cannot turn on you. Now, by moving small spindle over in slot, thereby throwing work out of center of lathe; you can turn tapers. The pitch of taper is determined by the distance you move over small spindle in tailstock center. When all is finished, Figs. 5 and 6 show it correctly. This device can be taken out of lathe at any time and common center put in, and I think it will pay for its cost in a short time.

A. T. W.

Several practical engineers and capitalists have associated themselves with John Roach, of New York, in forming the Rapid Steamship Company. The purpose of this company is declared to be the construction of steamships and other vessels, and mechanism and machinery for the propulsion of vessels, especially auxiliary screw propelling power to that heretofore ordinarily employed, calculated greatly to increase the speed of vessels. It is not proposed to establish any new lines of steamships, but the company expect to accelerate the speed of vessels used by existing companies.

The Indicator Diagram.

By F. F. Hemenway.

DIAGRAM FROM THE LINK MOTION.

The diagram in full lines, Fig. 12, is from a locomotive engine, with cylinders 16″x22″, at a speed of 248 revolutions, or a piston speed of 909 feet, per minute. This diagram is interesting as compared with those taken from engines with other forms of cut-off, since it is quite generally held to be a fact that the link motion is remarkably inefficient as a means of working steam expansively, the loss as compared with other means of steam distribution being variously estimated at from 25 to 35 per cent. In order more clearly to make this comparison, a hypothetical diagram has been plotted in dotted lines, which I believe will be accounted a very good one indeed for that piston speed.

The important points of loss in the distribution of steam by the link motion are claimed to be: A failure to approximate boiler pressure in the cylinder; too early release; excessive back pressure; too early exhaust closure and excessive clearance, the last in part being necessary to avoid too high compression incident to early exhaust closure. When this diagram was taken the boiler pressure was 128 pounds, and the cut-off at 8½″. The initial pressure is about 14 pounds less than boiler pressure.

Of this it may here be remarked that the highest point reached by the pencil does not, at high speed and sharp lead, especially when following considerable compression, represent initial pressure in the cylinder, but rather the inertia of the reciprocating parts of the indicator, which always under such circumstances carries the pencil too high.

Besides the lack of boiler pressure in the cylinder, there is a fall of pressure (initial expansion) of 19 pounds before cut-off. This lack of pressure at the beginning of the stroke and fall of pressure before cut-off represent loss. There is no evidence of material loss from too early release, and there is none too much compression for the amount of clearance space. The line of counter-pressure shows the back pressure to be about 6 pounds. The loss from this is apparent, but is modified by early exhaust closure. Some saving would result from reducing the clearance and compression—that is, if both were reduced.

Comparing the actual with the hypothetical diagram, the efficiency of the latter over the former is between 14 and 15 per cent., not 25 or 40 per cent. That is, assuming that the clearance, 7½ per cent., as represented by the full clearance line, could with safety be reduced one-half, as represented by the dotted clearance line; that the back pressure may be less than 2 pounds, and that as good steam line as that shown in the dotted diagram may be had, the dry steam exhausted would be 20 pounds per hour for the actual, and a little more than 17 for the hypothetical, diagram. This would not be all gain, as the somewhat greater extremes of temperature in the cylinder in the instance of the hypothetical diagram would result in correspondingly greater condensation, and hence loss.

It is customary with those who condemn the link motion to stop here and charge all this loss of efficiency to it. As a matter of fact, the link is responsible for only a very small part of it. To appreciate this it is only necessary to look at another condition, that equally with the valve motion influences the steam distribution, viz.: the dimension of ports. In this case the steam ports are 1¼″x14″, in area between $\frac{1}{11}$th and $\frac{1}{12}$th that of the piston. In the best stationary engine practice, with which it is the custom to compare the link motion, this proportion would not be accepted for a piston speed much greater than one-half that at which this diagram was taken; and to produce a diagram equal to the one sketched for comparison, from a modern automatic cut-off stationary engine, the area of ports would need to be nearly double what it is in this case. If the area of the ports is increased as indicated, and the link motion used, the most of this difference against it will disappear. The opinion that small ports are a part of the link motion, or at least that they are a necessity when the link is used, although entirely without foundation, is almost universal. By balancing, or relieving the valve of pressure, as is done in stationary engine practice, there is no more objection to large ports in one instance than in the other.

With regard to the 6 pounds back pressure, the outside lap of valve is ¾″, inside lap 0, hence the area of port opening for exhaust at the beginning of the return stroke is not less than 11 square inches, *while all the steam exhausted must pass through a nozzle having an area of only* 5 *square inches*, something not always considered in discussing the efficiency of the link motion.

The diagram shows, so far as a diagram from the link motion at a single point of cut-off and from one end of the cylinder can show, very correct valve setting. Compression cannot well be carried higher, because it is necessary to provide for shorter cut-off, in which the exhaust closure will earlier.

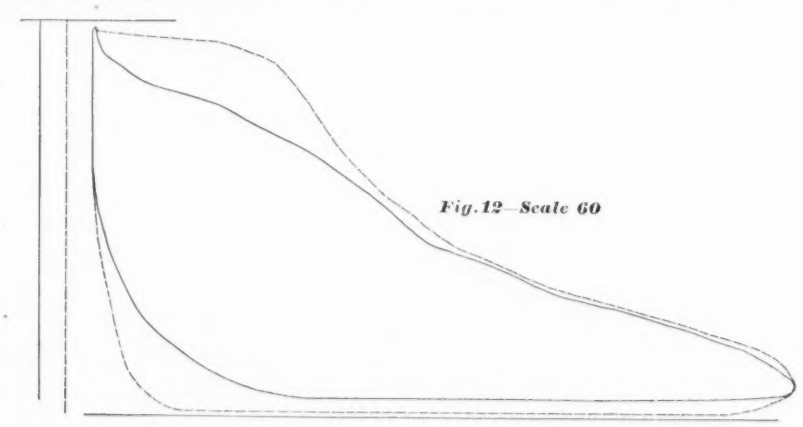
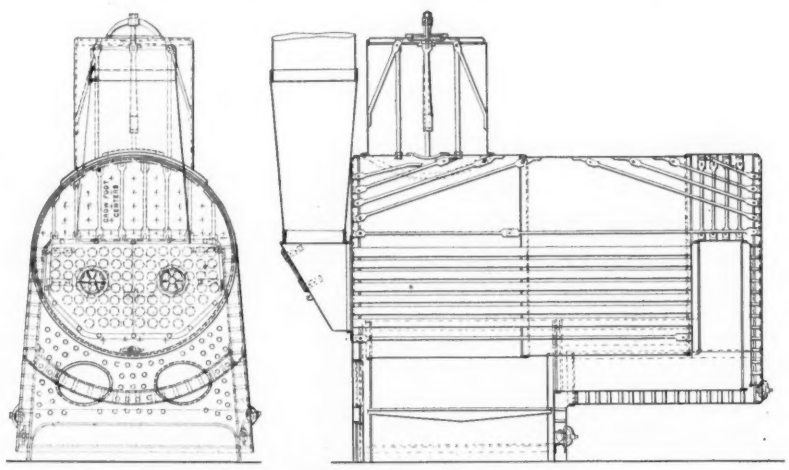


Fig. 12—Scale 60

Fitzgibbons' Patent Marine Boiler.

In this boiler, as shown in the engravings, a part of the shell is utilized for the top of fire-box, thereby doing away with the objectionable flat crown sheet and its objectionable stays. This also overcomes the difficulty ordinarily experienced in keeping the crown sheet free from scale, by leaving a chance for the free use of a scraper in the bottom of the shell, unobstructed by a multiplicity of crow-feet or crown bars.



Fitzgibbons' Marine Boiler.

The burning gases are conducted to the back combustion chamber, through a throat exterior to the shell instead of through flues within the shell, as in the ordinary marine boiler. This throat, as will be seen from the engraving, is enclosed on the top by the bottom of the shell, and on the bottom and sides by surfaces which are stayed with screw stays to the outside sheets, with water spaces between. This arrangement does away with the large flues, with their tendency to collapse, gives the entire shell for return tubes, allowing a greater heating surface in a given shell, and admits of the top row of tubes and the water line being kept low (in some cases almost down to the center line of boiler shell), thus reducing the amount of water necessarily carried and largely increasing the steam space. These two qualities are highly appreciated by tug men. This throat admits of a man passing by way of the furnace to the back combustion chamber, in case it becomes necessary to set tubes or make other repairs, thus doing away with the man-hole or back door in marine flue boilers.

As shown in the cut the water spaces are so arranged as to admit of free circulation of water in all parts of the boiler.

It will be noticed that the side sheets spread slightly from the shell down; this is in order to get the grate surface large enough, relatively to the heating surface, without making the grate bars too long.

In the design of these boilers about the following proportions are carried out:

Ratio of grate surface to heating surface	1 to 30
Ratio of grate surface to area through tubes	1 to 8
Ratio of grate surface to area through throat	1 to 7

Length of tubes in feet about four times outside diameter in inches.

Quite a number of boilers of this design have been made for tug boats and steam yachts.

Very satisfactory reports have been received from those boilers that have been in service several years, as to efficiency, economy of fuel, and absence of repair bills.

The improvements in this boiler are covered by patents granted to Patrick Fitzgibbons, and the boilers are constructed under his direction at the Kingsford Foundry and Machine Works, Oswego, N. Y.

Objections to Boilers of the Locomotive Type.

By George Marshall.

The locomotive type of boiler, in addition to the numerous braces riveted to crown sheet, which are thus unprotected by water, has also an objection in the screw stays by which the flat surfaces of sides and fire-box are connected together. As the greatest heat is in the fire-box it necessarily follows that there is much more expansion at that point than in the flat part of shell, which has only the temperature of the water within to affect it, counteracted in part by the current of cool air playing on the external part of the boiler. As boilers of this type do not require to be enclosed in brick, or protected by artificial covering, unless it is intended to prevent loss of heat by radiation, or where the location of the boiler requires a protection on account of workmen being employed in its vicinity, some steps are taken to prevent an addition to the ordinary summer temperature. Efforts have been made to overcome the disastrous effects of the screw stays, as considering the difference of expansion between the fire-box and shell, the thread of stay in time becomes affected and cracks become numerous; even breaks are not scarce. Locomotive builders and repairers use in different parts of their boilers a hollow screw stay, which on cracking or breaking manifests itself by leaking, and indicates the necessity of immediate repairs. The steamboat inspection service of the U. S. Government does not allow the use of stay bolts in any part of boilers built for marine purposes, hence resort is had to the old fashioned method of sockets and socket bolts. These sockets are usually made in the boiler shop from scrap iron, which cannot be used for other purposes, and as usually formed they are rough, heavy and unwieldy, but are as effective as the sockets made in some shops which are cut from steam pipe. The socket, after being formed, is put between the fire-box and outer sheet (care being taken when doing so to straighten up the sides), and is prevented from falling by the use of a wooden plug driven through from one sheet to the other. Where sockets do not come in contact with the fire, bolts are frequently used, the under part of the head being hollowed to hold a small quantity of cement. On the outside a "lipped" washer is used for the same purpose. Where fire contact takes place the usual custom is to rivet the bolts. This is done by using what is known in boiler-shop parlance as "socket bolts," but which in reality have no feature of an ordinary bolt about them, the head being shaped like a rivet head, round and conical, and no thread on any part of it. The bolt is usually heated from one end to the other, the head end being many degrees cooler, however, than the point. The riveters withdraw, or rather push the wooden plug through the sheets by means of a cold rivet, and the rivet boy or holder-on pushes the cold bolt out in introducing the heated one when the head is "held on" by the holder with either bar or sledge, and the usual rivet manipulation takes place on the outside. In steam chimneys and water bottoms cast iron sockets are frequently used, but they are not usually favored, as the upsetting of the hot rivet in the socket, which always takes place, has a tendency to break those of cast metal. In small boilers of the locomotive type screw stays are used to brace the crown sheet as well as the sides of boiler.

Looking at the matter of economy in space it is evident to any observer that in order to procure a boiler of equal power with the horizontal tubular, diameter of shell being equal, an addition must be made to the locomotive boiler to make up for the heating surface in the cylindrical shell of the horizontal, and this is done by the addition of the fire-box. The grates being entirely surrounded by water they prevent the loss of heat, which is usually absorbed by the fire brick in the horizontal type, and on this account the locomotive boiler is considered superior to the latter in point of economy of fuel.

As I said in a previous paper, more expense is incurred in the repair of a locomotive boiler than in one of the horizontal type, and it is no uncommon thing to see numerous patches in the crown sheet of the former, this being done to prevent tampering with the surface not affected by the heat and lack of sufficient water supply. There are boilers made, known as the locomotive return tubular, in which the products of combustion pass from the fire-box through a lower set of tubes to the back head, and thence through an upper set of tubes to the front head, and are then liberated into the stack or chimney. Boilers of this type can be made compact and powerful, and are usually used in tugs and small steamers; but these are more expensive than the other type of locomotive boiler, far more objectionable and cost more to repair. They are objectionable for the reason that in addition to the crown sheet being protected by the same style of stays or braces, part of the upper flues must be removed to repair the crown, also from the fact that the steam space in a cylinder used in this way must of necessity be cramped or else the shell of boiler is made of two

half circles with flat space between, this flat surface being strengthened by braces of the crow-foot type extending from side to side. When a round shell is used, it is the custom to put on a large steam dome or reservoir, but as steam domes are now considered of little benefit resort cannot be had to the dry pipe unless the greatest precautions are taken, as the agitation of the boiling water (the same being carried so close to the upper part of shell) will carry water into the cylinder, or supply moist steam. The locomotive return tubular has, however, one very important advantage over the ordinary type of locomotive boiler; that is, the protection afforded to the crown sheet by carrying tubes over the same. Should the water become low, the result would be the same as in the horizontal tubular; leaky tubes, while in the ordinary locomotive boiler the crown sheet would be excessively heated and distorted, brace rivets become loose, and in case of cold water being introduced collapse of crown or explosion may be expected.

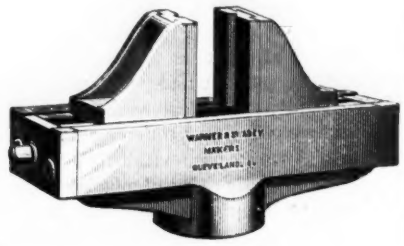
The so-called "Redfield boiler," occasionally used for steamboats is, simply a combination of the horizontal and locomotive boilers, giving the cylindrical shell and tubes of the former with the water legs of the latter. Where the union of the fire-box sides with the cylindrical shell takes place in this style of boiler, the greatest care must be taken to insure the maximum strength, as instances are known where collapse of the connection has taken place even when built (as supposed) in the very best manner. A great deal of influence is used by engineers when their employers are about purchasing new boilers, each engineer having a preference for or prejudice against all types other than the one he is most conversant with. In all cases it is not well to allow such a feeling to influence the purchaser. While engine drivers and engineers are usually classed together, care should be taken that the prejudice of the one should not be confused with the experience of the other. That it is done, however, is a matter of fact fully known to experienced parties. Considering the merits and disadvantages of the three types of boilers most generally used, steam users must be influenced solely by their own wants, economically considered, and the safety of themselves and employes. One of the greatest errors made in the general use and results of a steam boiler or boilers, is the lack of thought for an increase of business, or the use of more machinery than first considered sufficient. In such a case the engine and boiler being both overloaded, fail to give the satisfaction expected, and this dissatisfaction (unexpressed) is often used to the disadvantage of the maker of the first plant, the order for new work being given to another builder.

As a practical boiler maker, I would never advise the purchase of second-hand boilers, no matter how good they look, unless an examination was made by a first-class inspector and a strictly reliable boiler maker, as I have known more trickery in matters of this kind than ever took place in a horse trade, which we all know is usually considered the most fraudulent known. In the horse trade the purchaser has the teeth of the animal to guide him in regard to age. In the second-hand boiler, paint, like charity, covers a multitude of sins, while there is nothing to guide the purchaser as to age or durability except the inspection referred to. Many dealers in second-hand boilers and machinery will purchase old, plain cylindrical boilers for the shell, send the same to their own or some other boiler shop, have new heads put in, dome put on, and use, frequently, second-hand flues, test the boiler up to a good figure, carefully scrape and paint the old shell, and sell the same as a new boiler. Under these circumstances (which, of my own knowledge I know to be true) the purchase of a boiler from such dealers is attended with some little risk, and the practical knowledge and inspection referred to in the purchase of a second-hand boiler should be taken advantage of by the purchaser in this case as well. I do not wish to reflect on the integrity of those dealers throughout the country who are engaged in strictly legitimate business; the intention is to guide parties in purchasing to the side of safety, no matter whether the dealer keeps a store for the sale of new and second-hand machinery, or whether he keeps large boiler shops, as ready-made boilers, except those made by parties of known integrity, will stand the closest scrutiny, and never should be purchased on account of their appearance or the statement of their owner.

Special Chuck for Brass Work.

The engravings represent two forms of brass finisher's chucks, just put on the market by Warner & Swasey, Cleveland, Ohio. By the use of the revolving jaw chuck a variety of work, such as valves, fittings, &c., that require operations on several of their sides are finished by once chucking them, the jaws being revolved to the position indicated by the index to bring other sides or parts parallel with, or at right angles to, the part first finished. A great many uses for a chuck of this kind will suggest themselves to the machinist as well as to the brass finisher.

Revolving Jaw Chuck.



Box Chuck.

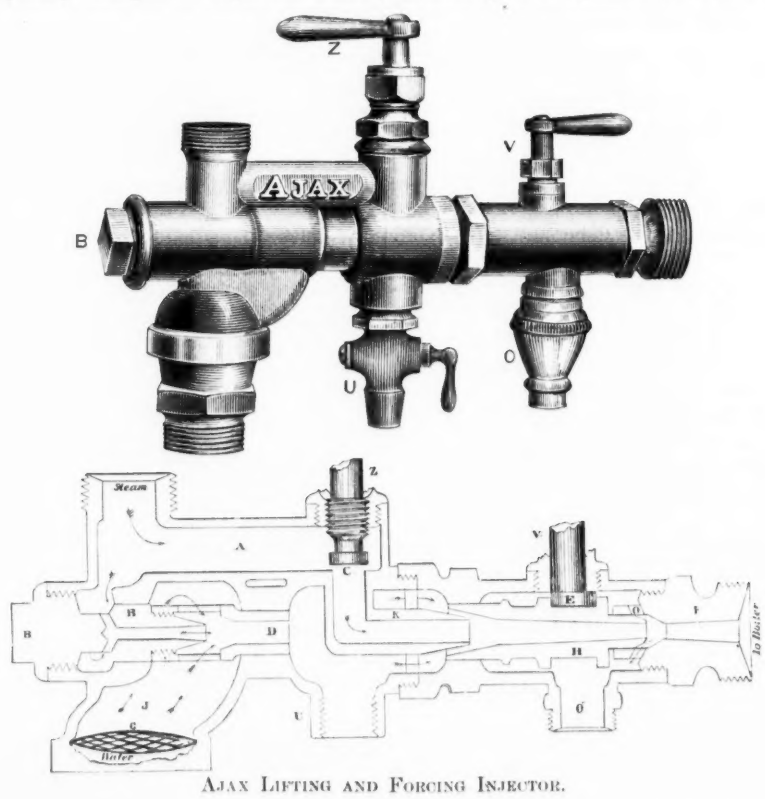
The box chuck is made with long broad steel jaws, the jaws having dovetail faces for admitting supplementary iron jaws which can be fitted for special work, and can be very quickly changed as required. These chucks are threaded to the lathe spindle in the ordinary manner, and are made in a variety of sizes.

The *Locomotive Fireman's Magazine* draws attention to the inconsistency of the railroad companies that object to their employes using intoxicating liquors, yet hire out part of their depots for the sale of strong drink. If railroad companies wish to have sober men, they ought to take away the temptation offered by drinking bars attached to the refreshment rooms, where most of the train-men take their meals. Self-interest ought to be powerful enough to induce railroad companies to make this reform, for one wreck caused by the inducement to carelessness or recklessness imbibed at the depot bar will generally cost more than the profits of these bars will amount to in ten years. Where depot bars are permitted, one smash in six months from bar influence is a low estimate.

We have several times expressed the belief that our rural swains, whose leisure hours are increased by the inclement weather of a severe winter, turn their ingenuity in the wrong direction when they are devoted to the invention of rotary engines, car starters, car couplers, and sewing machines. Inventing is like writing articles for technical journals insomuch as knowledge of the subject is essential to success. A recent patent shows that one rural inventor has "stuck to his last," for he has exhibited immense ingenuity in producing a hen's nest which is constructed so that no rival chick shall disturb the producer of eggs while making her daily deposit. The nest is hung on a lever, which automatically closes the entrance so soon as a hen gets into the nest. A striking feature about the arrangement is the melancholy aspect of the chick waiting outside for her turn on the nest.

The "Ajax" Lifting and Forcing Injector.

The injector shown in perspective and section is the invention of, and is manufactured by, J. D. Lynde, No. 1 Fetter Lane, Philadelphia, Pa. In the engravings *B* and *D* are the lifting tubes, *H* and *K* the forcing tubes, the tube *H* being adjusted by means of the eccentric *E*. *C* is the forcing steam valve, and *G* a screen which prevents any substance large enough to clog the tubes from entering with the water.



Ajax Lifting and Forcing Injector.

To operate this injector when lifting the water, the valve *C* is closed by means of the handle *Z*, *U* is opened and steam turned on. When water appears *U* is closed, and *Z* is opened slowly, *V* being used as a regulator. After the first adjustment *V* does not require moving except for considerable changes of pressure.

If water is delivered under a head of not less than two feet the injector may be started when set as above described, by simply opening the water valve, then when water runs full at overflow open steam valve slowly, regulating as required.

It is claimed for this injector that it will work through a very large range of pressures without adjustment, that it is of few parts and easily understood, and is not liable to derangement.

Machinery Hall at the New Orleans World's Fair will be 250×1500 feet. A railroad track will run through the center and another along the rear of the building. The pumps exhibited will raise water to a large tank on the roof which in turn will supply a cataract 40 feet high and 40 feet broad.

Direct Railroad Connection with Mexico.

Parties who wish to visit Mexico for business or pleasure may travel by rail to the City of Mexico, the Mexican Central Railroad being now open for through traffic. Mexico moves slow, but nothing could do so much to accelerate the progress of its people as the opening of free communication with our enterprising citizens. As a natural sequel to the opening of the railroad connection, a great industrial exposition is proposed to be held in the City of Mexico. Anything of that kind which is calculated to show the natives what other people are doing, must have a beneficial influence in creating a desire to adopt better methods of doing work and improved tools to work with. The discontent with their antiquated processes will raise a demand for new agricultural and mining machinery. For years the United States will receive the greater part of the orders for supplying the machinery that is going to place Mexico's social fabric on the level with that of other civilized nations. The Mexican Central Railroad was built with American capital, and pushed forward by American energy. Its plant is mostly of our make, and its operation is controlled by leading men from our railroads.

"Throttle Valve Opening and Steam Chest Pressure."

As of interest in connection with a letter from a correspondent on the above subject (American Machinist, March 22), a well-known engineer informs us of an experiment recently tried, which demonstrated that steam enough would pass through a hole 1½" diameter to supply an engine doing more than 200 horse-power of work, the boiler pressure being 90 lbs, and the engine working against 20 lbs. back pressure. The experiment was made because it was claimed that the steam pipe was too small to supply the engine with steam, it being reduced from 12" to 8" for a few feet of its length. Such experiments are of interest if they do overturn considerable theory, which in several instances we know of has led to the use of throttle valves one size larger than the steam pipe, to prevent "choking" the supply. As the gentleman to whom we are indebted for the above information suggests, there is a difference between "theorizing about a thing and trying it."

Progress of the Keely Motor.

The announcement is made that all the workmen engaged in the construction of the Keely motor have been discharged. This includes the head mechanic, who has been on the job for seven years. We always feel sympathy for men who lose employment, but we think those who received work on the Keely motor for seven years were exceedingly fortunate, and therefore we conclude that the enterprise has done good to some people. The reason given for the discharge of the workmen in question was that the motor is finished, and all that is left to be done is the starting of it—an operation which is left to the inventor. This is said to be a delicate but not difficult operation, the great trouble being the first revolution. When that movement is achieved, we are assured the motor will be perfect. Although the great consummation of this scheme is reported to be just at hand, we still believe that the means of making that first turn is lacking. And we are afraid that the inventor will not be granted many more years to perfect the machine, for the stock shows an ominous downward tendency—a curious phenomenon at the time when the holders are proclaiming that immediate success is assured.

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NEW YORK, APRIL 5, 1884.

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Small Machine Shops.

The position of the small machine shop is by no means what many believed, a few years ago, it would be. Then it was very generally argued that the extended use of special and costly machinery and tools would concentrate business in a few large manufacturing establishments, which would, from the magnitude of their operations, be able to provide facilities for doing work cheaply, quite out of reach of the smaller shops. So far from these predictions being verified, the proportion of small to large shops is about the same now as ever, with no prospect of material change in this respect. When, in small shops, the mistake is not made—a very natural one—of trying to spread operations too much, the growing use of special tools is found to be of about as much benefit as in the larger ones. In many instances, owing to the thought that has been given to the subject by tool builders, the cost of machinery for special work has, within the past few years, been greatly reduced, placing it within the reach of those who could not otherwise afford to use it; and in other instances, large shops, having gone to the expense of providing for the economical manufacture of special parts to supply their own wants, are willing to extend their business to supply those of others. In still other instances—and they are rapidly multiplying—parts and pieces that were made in every shop, are made and sold as articles of special manufacture, all of which the shop of limited capacity can and does take advantage of.

By a greater degree of co-operation amongst owners of small shops—mutually supplying one another's wants in specific directions—the cost of tools for manufacturing advantageously might often be materially reduced, or several small manufacturers might have substantially all the advantages of tools that neither could afford for his individual use. In such ways as this there is undoubtedly room for doing a great deal more than has been done.

In small jobbing shops there is almost universally a tendency to cover too much ground. Frequently, in some town, a half dozen such shops may be found, each doing the same class of work—that is, anything there is to be done—and, as a result, not properly equipped for doing any single thing. By mutual understanding and a fair division, in which each should confine himself to certain lines, it would be found that for a less expenditure they could all put themselves in condition to do better and cheaper work, all make more money and give better satisfaction to customers. Looking through all these shops, about the same line of patterns will be found, and in the busiest times a good deal of machinery will stand idle, because on the whole there is too much of it, while, as it is divided, neither has enough. Reformation in this respect would work a real benefit, and give the small shop better prospects of competing with more pretentious ones.

Increasing the Power of Public Boards.

There is a tendency among our people to magnify the value of public boards and invest them with omnipotent power. This is quite the opposite kind of sentiment to that which has been growing in Britain for years, where boards are regarded as good only for preventing the public from locating the responsibilities for mistakes and mismanagement. Since the era of boards of railroad commissioners came in, the people of some States seem willing to depute powers to these boards which no State has ever assigned to its Chief Magistrate. Many corporations and individuals among us are too little amenable to law, but it remains for railroad commissioners to be raised formally above the law. One of the latest movements to magnify the importance of these irresponsible boards is a proposal to give the railroad commissioners of Iowa power to license all railroad conductors, and to prevent railroads from employing conductors who are not so licensed. It is hard to see where the traveling public would reap benefit by having conductors examined by a board, not one of whose members could run a train two miles, with safety. The railroad commissioners have valuable functions to perform in supplying information about railways and in enlightening the people as to needed legislation, but they should not be created autocrats of all matters pertaining to railroad business.

Laws to Discourage Invention.

Two bills have been quickly advanced in the House of Representatives, one of which reduces the period for which patents will be granted to five years; the other proposes virtually to permit the buyer of a patented article to assess the value of the patent. The members of the house were so much occupied with purely political business that they did not seem to know what the contents of these outrageous bills were. Most countries that have made leading progress in industrial pursuits have owed some part of their success to wise government co-operation and judicious legislation. This country has been a conspicuous exception to this rule, for its industrial progress has proceeded solely from the ingenuity and unaided perseverance of its citizens whose efforts in many instances have been obstructed by adverse legislation. One cannot study the growth of American manufactures without being struck with the apathy or open hostility displayed by our legislatures towards the interests that have done so much to enrich the nation. The national legislature appears to be crowded at present with men hostile to the nation's prosperity, or these two bills destroying the value of patent property would not have escaped earnest protest. The inventive genius of America has enabled our manufactures to be built up on their prosperous base, and the enactment of laws that tend to destroy the incentive to invention cannot fail to have a disastrous effect. It is an outrage on the country that the men sent to Congress for the purpose of watching over the nation's interest should be active in passing measures that will assuredly effect injury to the whole community. These insidious assaults on our patent laws are promoted by unscrupuleas rascals who wish to obtain other people's property without paying for it.

We direct the attention of master mechanics to the cuts of improved rod ends described by Mr. Hollister, on another page. We believe that rod straps made in that way have many advantages over the old style, and that any one who tries them will feel constrained to extend the practice.

The immense drain of the multitude of steam boilers that are in use on our coal resources pointed to a time not exceedingly remote, when all our coal would be exhausted and a universal want of steam would result. Being interested in the prosperity of posterity, we felt sad when these reflections obtruded themselves upon our mind. Calculations made by a mathematical member of this office have recently given us a crumb of comfort. There is a furnace company in New York City with a patent furnace, which they claim makes steam without expenditure of coal. That is, hardly any coal, which, to the minds of ardent stockholders, seems none at all. In another part of the country another genius claims that he can keep the steam in the cylinder ten per cent. higher than the boiler pressure, merely by a peculiar arrangement of steam pipes. Our mathematician claims he can combine the furnace that makes steam without the expenditure of fuel due to the chemical process of combustion, with the pressure begotten from nothing to form a perpetual motion machine. He has not yet had an opportunity of examining the furnace, so his plans are not prepared, but he expects to be permitted to see it as soon as most of the capital stock of the company has been placed. When his combination is arranged, it will no doubt revolutionize the application of power by cheating old Nature. We shall not fail to advise our readers of the result, and we merely give this preliminary intimation of what is going on, so that parties interested in coal companies and other industries that will be ruined may have time to unload.

A committee of the Railway Master Mechanics' Association have sent out a circular asking for information about wheel treads. They wish to obtain data of the experience of those who have used straight and coned treads, so that an intelligent comparison may be made as to which form gives greatest satisfaction in running and wear.

Literary Notes.

The Locomotive. Published by the Hartford Steam Boiler Inspection and Insurance Company, Hartford, Conn. New series, Vol. IV., 1883.

We are in receipt of a bound volume of this publication, embracing the numbers issued during the year 1883. It contains more than 200 pages of reading matter, of a kind that is particularly valuable to engineers and steam users. Although more particularly devoted to matters pertaining to boiler construction, setting, and use, boiler explosions, etc., there is much other matter in it that is of interest to the engineer as well as to the general reader. We do not know that the bound volumes can be obtained, but the numbers are sent free during the year to any one interested in the matters treated, and we can in the best faith advise every one connected with the management of steam boilers to read the numbers for this year.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(140) W. K., Detroit, Mich., asks: Who was the inventor of the safety valve? *A.*—The invention is usually ascribed to Papin, nearly 200 years ago.

(141) A. N. L., Pittsburgh Pa., asks: If the pressure in a cylinder is 60 lbs., will the pressure against the piston be the same at ⅛″ as at 1″ from the end? *A.*—Yes.

(142) P. P., Yonkers, N. Y., asks: Can I cut 11½ threads to the inch with a lead screw 4 to the inch and the following gears, viz.: 24, 36, 48, 60, 66, 72, 78, 84, 90, 96, 102, 108, 120, 132? *A.*—No.

(143) G. E. S., Wrentham, Mass., asks: How large a boat, and what size propeller will be suitable for an engine 3½″x5″? *A.*—Length of boat, 25 to 30 feet; beam 5½ to 6 feet; propeller, 26″ diameter; 34″ pitch.

(144) J. B. F., Chicago, Ill., asks: When two horses are attached to an evener, and one is constantly in advance of the other, which pulls the most of the load? *A.*—We cannot see that there will be any difference, practically.

(145) J. G., San José, Cal., writes: Some time since I worked with a brass finisher, who made tools of brass which were tempered and used by him for turning brass, chasing threads, etc. Have you any idea how it was done? *A.*—No.

(146) E. G., Cleveland, O., asks: In making a friction disk and face-wheel, what material should they be covered with? *A.*—We think if you cover the disk with leather, turned off true, making the disk and wheel of cast iron, they will work satisfactorily.

(147) L. L. E., Trinidad, Col., writes: I wish to transmit 25-horse power with wire rope. The shaft from which the power is to be taken runs 95 revolutions per minute, and the shaft to which power is to be taken will be 12 feet above, at right angles to the first shaft, and will run 75 revolutions per minute. What size pulleys and rope shall I use? *A.*—We cannot recommend the use of wire rope under these conditions.

(148) A. S. E., New York, asks: 1. What is the rule for finding the gears for cutting screws in a compound-geared lathe? *A.*—See "Screw Cutting on the Engine Lathe," by Frank H. Richards, in the AMERICAN MACHINIST of August 13 and 20, and October 15, 1881. 2. What is the use of the expansion valve on a marine engine, and where is it placed? *A.*—The expansion valve is used for the purpose of cutting off steam, so as to work it expansively. It is quite commonly placed on the back of the main valve.

(149) J. O. H., St. Louis, Mo., asks: How can I ream holes 5-16″, 3/8″, and 7-16″ diameter through gun-metal 2″ to 4″ thick? The holes must be true and straight. I use a solid reamer, but the holes are largest at the end from which the reamer is started, and the reamer chatters. *A.*—It is not easy to ream a hole exactly straight with an ordinary fluted reamer. You can probably accomplish your purpose by using a reamer with teeth for not more than one-half inch from the end, and the body of the reamer straight and ground to exact size. This will also prevent chattering.

(150) C. H., Hudson, Mass., writes: I have two shafts; one a stiff one, upon which is a 3 foot pulley, 8″ face, which drives a 1 7-16″ shaft 50 feet long, upon which is a 15″ pulley 10″ face. The small shaft runs 400 revolutions per minute. I use an 8″ single belt. Can I lag up the 3-foot pulley with wrought iron and use a 10″ double belt, or would it strain the small shaft too much? *A.*—You can safely make the change indicated, so far as any danger of twisting off the shaft is concerned, but it will be a rather heavy strain on the shaft, and will tend to spring it, and heat the journals. By placing bearings near the pulley you can probably make it work satisfactorily.

(151) A. G., West Belleville, Ill., asks: 1. Is it proper to straighten shafting between the centers of a lathe, using a bar and hammer? *A.*—There may be circumstances where it is admissible to straighten a shaft in this way, but, generally speaking, it is not right. Shafting straightened in this way is only held straight by the tension of the iron on the surface at and near the hammer marks, and there is a constant tendency for it to go crooked again, which it is certain to do should this outer surface wear off, as in a bearing. 2. Which of the two places are best for learning the machinist trade, a manufacturing shop or a repair shop? *A.*—There is no material difference.

(152) K. & Y., Freeland, Pa., asks: 1. Will you give me the estimated horse-power of two common shell boilers (no tubes or flues) each 30″ diameter and 15 feet long, the pressure of steam being 80 lbs.? *A.*—It is boiler-makers' custom to reckon 9 square feet of heating surface in such boilers for a horse-power. The heating surface in the two boilers is 117.8 feet, and hence, on this basis, the horse-power is 117.8÷9=13+. 2. What would be a proper size of stack for these boilers? *A.*—The area of cross section of opening in stack may be 2 square feet. 3. Will a No. 8¾ Hancock inspirator be proper for feeding these boilers? *A.*—It might be found large enough, but we should prefer a size larger.

(153) C. E., Como, Col., writes: 1. I have recently set up a pair of 14″x30″ engines for hoisting, in a mine. They have no fly-wheel, but have heavy cranks and rods and no counter-balance. The cranks are not at right angles by ¾″. In starting, the engines are jerky. The valves cut off at about two-thirds stroke, and I gave them 5-64″ lead. The speed is from 20 to 100 revolutions. Can I change the lead so as to make them run smoother? *A.*—It is doubtful if you can accomplish much by changing the lead of valves. You may help matters slightly by reducing the lead, say, so that the valve does not begin to open till the crank is on the center. Counter-balancing would help more than this. 2. What lead should a pair of engines 9″x12″ have, used for the same purpose and running at 200 revolutions? *A.*—Not to exceed 1-32″.

(154) W. H. C., Jamestown, N. Y., writes: We are running a 200-horse power engine, and want to get rid of the exhaust steam. Can we carry it about forty feet on a level and then twenty feet down and into a creek, and then carry the pipe along horizontally twenty feet? The water will be from 3″ to 2 feet over the pipe. Will it cause back pressure? Will it be any advantage to perforate the pipe? *A.*—You can dispose of the exhaust as you suggest. Perforate the pipe at the bottom and sides with ⅛″ holes. The only thing you will need to fear is drawing water into the cylinder when shutting down. There will not be much danger of this if the height is twenty feet, and not any with the cylinder cocks open to the atmosphere. There will be about one lb. additional back pressure for every two feet the pipe is under the water.

(155) E. W. B., Paris, Texas, writes: 1. We have an engine 10″x20″, running at 105 revolutions, using steam at 60 lbs. pressure. The valve has 5/8″ lap, and by means of a rock-arm the travel of the valve can be varied between 2⅜″ and 3⅜″. How can I set the valve so as to cut-off at ¾ stroke? *A.*—Make the travel of valve 2⅝″, lead 1-32″, and the average cut-off will be substantially at ¾ stroke; that is, it will cut-off a little earlier than at that point on one end and a little later on the other. 2. We are about to reset our boiler, which is now set as per sketch. Can you suggest any better way? We burn wood and what shavings we have. *A.*—The sketch shows a two-flue boiler, 40″ diameter and 24 feet long. The grates are 14″ below the boiler, and the bridge-wall slopes up to within 3′ of boiler, and continues, apparently, for four or five feet. Back of the bridge-wall, the distance up to the boiler is 12″, sloping down to a distance of 18″ at the back end. *A.*—We should put the grate not less than 30″ below the shell, then slope up the bridge-wall from the end of the grates, leaving 6″ space between the bridge-wall and shell. The bridge-wall need not be more than 15″ on the top. Just back of the bridge-wall let the distance below shell of boiler be 16″, and slope up to 10″ at the back end.

(156) P. Q. B., Waterville, N. Y., writes: 1. It often happens that lead pipe gets cut with water running in it at high velocity. How can I join the broken parts when the pressure of water is on the pipe? *A.*—We suppose you mean to join by soldering. We do not see how you can do it. 2. Please give me a rule for striking out a circular elbow? *A.*—This can only be given by the aid of a diagram. You will find it in any book on sheet-metal working. 3. How can I bend copper or brass tubes? *A.*—By filling them with melted rosin.

BUSINESS SPECIALS

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Gears—G. B. Grant, 3 Alden st., Boston; water motors

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Models & Mach'y—G. D. Lambert, New Haven, Ct.

INVENTIONS perfected, designed, or patented. E. P. Robbins, M. E., Cincinnati, O.

One set vertical engine castings 1½ H. P. Send for blue-print. A. H. Lefebore, Watertown, N. Y.

For first-class machine patterns and estimates, address John Valentine, 15 Alling st., Newark, N. J.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Fine tools and special machinery. Horace Thurston, 84 Clifford street, Providence, R. I.

Spanish translations of catalogues, circulars, &c. J. M. Da Rosa, 260 East 3d St., Cincinnati, O.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Universal grinders for lathe-centers, chucks, angles, or cylinders. C. C. Hill, 84 Market st., Chicago, Ill

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Herbert W. T. Jenner, Mechanical Engineer and Solicitor of Patents, 626 E st., Washington, D. C.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Split Pulleys at low prices, and of same strength and Appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

The "Wax Process" Engravings shown in the AMERICAN MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

New Books, relating to steam, the steam engine, mechanics, machinery, and engineering. Send for catalogue. Fred. Keppy, publisher, Bridgeport, Conn.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large: prices low. Frasse & Co., 62 Chatham St., N. Y.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

BOUND VOLUMES of the AMERICAN MACHINIST for 1880, 1881, 1882, and 1883, for sale at $3.50 per volume, express charges to be paid by purchaser. AMERICAN MACHINIST Pub. Co., 96 Fulton Street, New York.

EXTRACTS FROM CHORDAL'S LETTERS, 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with over 50 illustrations. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

Useful Information for Steam Users—A 100-page pamphlet, compiled from the best authorities, on the care and management of the steam engine and boiler, with hints and rules for engineers and firemen. Engineers everywhere should have this work. Send 25 cents in P. O. stamps for a copy. The J. N. Mills Publishing Co., 145 Broadway, N. Y.

MANUFACTURES

Scally & Co., Louisville, will erect a $6,000 building for foundry.

Extensive machine shops are to be erected in Waycross, Ga.

The Kentucky Woolen Company, Louisville, Ky., will build a brick mill.

A. C. Stickney & Co., Oxana, Ala., are to build a foundry and machine shop.

T. L. Sewell, of Macon, Ga., contemplates starting a foundry in Brunswick, Ga.

Henny & White, McKinney, Tex., are erecting a planing, door and sash mill.

Dennison, Texas, wants a large machine shop. It has about ten thousand population.

J. T. Finger will erect machine shop and agricultural implement factory at Newton, N. C.

F. J. Chapman, Salem, Va., is trying to raise capital to build a blast furnace at that place.

The St. Louis Malleable Iron Company will soon begin the manufacture of malleable hollow ware.

John O'Brien & Co., boiler manufacturers, St. Louis, Mo., are building a 30x100 feet addition to their shop.

John C. Hewes 136 Prevost street, Brooklyn, N. Y., will ereet a factory, 120x60 feet, and an engine-room 20x26 feet.

Denis McGrath is removing his boiler works from St. Louis to Texarkana, Ark., and will be ready for work at the new place April 1st.

Ketcham & McDougal, York and Washington streets, Brooklyn, N. Y., are to erect a six-story brick factory at a cost of $24,000.

Henry A. Dingee, 128 East 61st street, New York, will erect a six-story brick factory, at 468 and 470 Cherry street, to cost about $20,000.

The Union Flouring Mill, McKinney, Tex., is being converted into a cotton-seed oil mill, which is to be one of the largest capacity in the State.

The machinery of the Cincinnati Wire-Nail Company has been sold to Indianapolis capitalists, who will engage in the manufacture of wire-nails in that city.

Sufficient funds have been pledged to secure the erection of a shoe factory in Concord, N. H., early next season, that will give employment to four hundred hands.

$125,000 has been raised for a cotton mill in Knoxville, Tenn., a site purchased, and building will be commenced very soon. A large woolen mill in same city is also probable.

Z. T. Harris, who was about to start a foundry and machine shop at Ocala, Fla., has purchased an interest in the machine shops at Gainsville, and the project at Ocala has been abandoned.

The L. D. Thayer Manufacturing Company has been formed in Worcester, Mass., with a capital of $10,000, for the manufacture of cotton, woolen, and silk fabrics. L. D. Thayer is president and treasurer.

The Washington Iron Works, Sherman, Texas, write us: We see in your paper, No. 12, that the "Sherman Iron Works" had increased their capital to $20,000. It should have been, Washington Iron Works.

The Cragdale Cotton and Woolen Manufacturing Company of Talladega, Ala., has been incorporated. Capital, $100,000. Dr. William Taylor, R. H. Isbell, J. H. Johnson, J. P. Wood, W. G. Sears, and W. H. Skaggs are the incorporators.

As showing that the steam engine trade is in fairly good condition, we were shown recently by Mr. Craig, of the Craig Lubricator Company, Lawrence, Mass., orders taken in one day for 102 of their cylinder lubricators.

The Revolution Tool Company will soon be established at Woonsocket, R. I., to manufacture Porter adjustable wrenches, and other tools. D. R. Porter, of Boston, is president, and J. W. Cass, of Woonsocket, treasurer and general manager.

The Parker & Young Manufacturing Company, of Lisbon, Vt., has been organized with a capital of $20,000, for the manufacture of piano sounding-boards, packing boxes, chair stock, bobbins, and the general manufacture and sale of lumber.

D. L. Wilcox, of Pawtucket, R. I., has resigned the presidency of the R. Bliss Manufacturing Company of that city, and organized a stock company with a capital of $25,000, with a toy and wood-work factory at Milford, N. H., and an office in Boston.

The directors of the new Co-operative Stove Company, recently incorporated in Buffalo, N. Y., are John H. Ludwig, Edward Keener, Augustus Voss, William H. Beyer, Jacob Shoemaker, Gerald O'Brien, Frank M. Geise, William H. Baynes, and Samuel Hoffman.

The Boston *Bulletin* says: It is rumored that several North Adams, Mass., capitalists contemplate starting a new manufacturing business there, with $100,000 capital. They are very quiet about their plans, but have already taken the preliminary steps for a charter.

The Art Metal Company, Wallingford, Conn., has been incorporated with $50,000 capital. All the officers and stockholders are skilled workmen, and no stockholder can vote on more than $10,000 of stock. A New York firm has agreed to take all the goods they can make for ten years.

The Bramhall & Fuller Tool Manufacturing Company, Westport, Conn., will soon begin the work of fitting up the large brick factory on the west bank of the Saugatuck river, which has been unoccupied since it was built. They have a ten-years' lease of the building, with the privilege of buying.

The Time Telegraph Company, Temple-Court Building, New York City, expect to occupy for their factory two floors of a large building, just completed in Brooklyn, on Pearl street, near Prospect. The company will put in machinery for the manufacture of every kind of electric clock devices.

The officers of the new Lewisburg (Pa.) Nail Works are as follows: William H. Croft, president, present address, Milton, Pa.; E. Milo Purdy, secretary, present address, Northumberland, Pa.; Col. T. B. Purdy, treasurer, present address, Sunbury, Pa. The mill will be built as soon as possible.

The stockholders of the Paris (Ill.) Co-operative Tool Company have effected an organization with the following officers: President, John Hemphill; vice-president and treasurer, John R. Tate; secretary, John T. Uselton; manager of works, Louis Barrord. Directors, Warren W. Grim, William S. Uselton, Michael Cunningham, William Covenay, and Robert Zimmerman.

The Durham Cotton Mill, of Durham, N. C., has organized, with capital stock $150,000, of which $90,000 is already paid in. President, Jas. A. Odell, of Greensboro, N. C.; vice-president, J. M. Odell, of Concord; secretary and treasurer, W. H. Brandon. Work on building to be commenced at once. Will also build cotton-seed oil mill.—*Baltimore Manufacturers' Record.*

The Great Western Stove Works, Leavenworth, Kan., will put up an additional foundry of brick, 75x135, with mounting shop attached, 75x75, and brick building for new engine, boiler, and blower, 30x30. They will put in a new engine, boiler, blower, drill lathes, emery grinders, etc., to supply new manufacturing shop. The capacity of works now is 30,000 stoves per annum.

Ground is being broken for a four-story and basement factory, 36x218 feet, for Knisely & Miller, Chicago. A wing, 75x40 feet, will also be added to their present works. The company are placing several thousand dolars' worth of new machinery in their works, included among which are a 150-horse power engine and a battery of two boilers. The improvements above mentioned are expected to be completed about the 20th of May.—*Industrial World.*

Frick & Co., of Waynesboro', Pa., manufacturers of "Eclipse" traction, portable and stationary engines, boilers, threshing machines, cotton gins, sawmills, and horse powers, besides establishing seven branch houses, throughout the country, have found it necessary to run a branch factory. This has been accomplished by contracting with Thomas Camp to operate the Pioneer Machine Works, at Covington, Ga. The company have their own manager, and the business is controlled by him.

The Galveston, Harrisburg, and San Antonio Railroad Company intend building large repair shops at Houston, Texas. The shops will have facilities for doing the work needed for all the Southeastern division of the Central Pacific (to which that road belongs). They will cover an area of 1,800 by 1,200 feet at first. About seven hundred men will find employment in the works. The work of construction will occupy nearly a year, and it is expected that a beginning will be made directly.

The Laclede Car Manufacturing Company are so pressed with orders as to necessitate the enlargement of their works. The new paint-shop, for the erection of which bids are now being received, will be 60x130 feet, two stories high, and the additional blacksmith-shop 58x100 feet. The latter will contain two steam hammers, six forges, and one furnace. The enlarged works will give employment to over 100 men, and will turn out a car a day, the intention being to increase the capacity of the works to two cars a day before improvements are dropped.—*Age of Steel.*

A new $3,000,000 company has been formed at Birmingham, Ala., by the consolidation of the Pratt Coal and Iron Company, Alice Furnace Company, and the Linn Iron Company. About 100,000 acres of coal and iron land, two blast furnaces, and a large number of coke ovens constitute the property to be managed and developed. It is proposed to build at least two more blast furnaces. The officers are: E. Ensley, president; J. C. Neely, vice-president; J. H. Smith, secretary; T. D. Radcliffe, treasurer; W. L. Gude, superintendent.

Betts Machine Company, of Wilmington, Del., report an improvement in the machine tool business since the first of the year. They have lately taken an order from the Harlan & Hollingsworth Company, iron steamship builders, of Wilmington, for a large boring and turning mill. This machine, when completed, will be the largest tool of its kind in the State, and will be capable of dealing with the heaviest class of work. It will swing 14 feet diameter and 10 feet high under the toolholders; made very heavy, and of great power. It will weigh 100,000 lbs., and be in running order by July 1st.

McMurray & Stoughton, Hartford, Conn., write us: As we are the present makers of the Medart Wrought Rim Pulleys, the paragraph in your last issue, which records the breaking of a Medart pulley while running in the Saunders Cotton Mills, might do us injury, by leading manufacturers to doubt the durability of our work, if it were not explained that this pulley was made by our predecessors, the Hartford Engineering Company, at a time when its proper manufacture was not understood, and that its weakness was the effect of poor workmanship purely, and not of design. We have ourselves made and sold over twelve thousand pulleys, of all sizes, from 12″ to 114″ diameter, and not one has shown a sign of weakness, or in any way failed to give absolute satisfaction.

The Portage Straw Board Company, Circleville, O., which is erecting a mammoth board mill, was delayed some last winter by reason of bad weather. The machinery is now beginning to arrive. Twenty-eight car loads from Beloit, Wis., were paper machinery alone. The engines come from Milwaukee; beater engines from E. W. Ross, Fulton, N. Y.; rotary globe bleachers (eleven in number, fourteen feet diameter) from J. C. McNeil, Akron, O.; boilers from the Babcock & Wilcox Company, of New York.

Dean Brothers Steam Pump Works, of Indianapolis, have recently received orders for their Independent Air-pump and Condenser from the Logansport (Ind.) Electric Light Company; Clinton (Iowa) Water Works; Yaeger Mill Company, Kane, Ill., and Brush Electric Light Company, Indianapolis. Dean Brothers are getting out patterns for a new line of duplex pumps.

Machinist's Supplies and Iron.

New York, March 20, 1884.

There has been a slight upward tendency in the market during the week.

Iron—American pig preserves a steady tone. One additional furnace is reported in blast since last week. No. 1 X Foundry, $20.50 to $21; No. 2 X $19 to $20; Grey Forge $16.50 to $17.50.

Scotch pig—Coltness, $21.50 and $22 to $22.50 from yard; Glengarnock, $21 to arrive, $22.50 yard; Gartsherrie, $21 to $22; Summerlee, $21.50, to arrive, $22 yard.

Copper—No change in the market since last report. For ingot Lake, 14⅞c., and other brands are quoted from 14c. to 14¼c.

Lead—Common pig has ruled quiet and steady. Sales have been made at 4¼c.

Tin—The market has ruled steady, though not active. Prices lower than those quoted last week. Banca, 19¼c.; Straits and Malacca, 18¾c. to 18¾ c.

✲WANTED✲

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Experienced mechanical draughtsman wants engagement. Address E, Box 8, Am. Machinist.

Experienced mechanical engineer, theoretical and practical, will shortly be open for engagement. Address "Pa.," Box 4, care Am. Machinist office.

A tool-maker, experienced in all tools required for lamp, button, and other brass goods, wishes a situation. Address W. M., Box 753, Waterbury, Ct.

Pattern-maker, of more than 20 years' experience, on all kinds of work, desires situation. Used to managing men. Address Box 3, Am. Machinist.

Situation wanted, as foreman of a boiler shop. Have had 20 years' experience as foreman, and am conversant with marine stationary and locomotive work. Address George Marshall, care American Machinist.

A young man, aged 26, practical steam-heating engineer, wants to form partnership with a young man of means, in growing Western city. Satisfactory references given and required. "Steam," care Am. Machinist,

Wanted—A good moulder, with a small amount of money, to operate on his own account or on shares with the owners. A new foundry being very nearly completed, and that can command a large trade. For full particulars, address Box 338, Dallas, Texas.

Wanted—A position as foundry foreman, by a practical moulder, in iron or brass. Has charge of thirty men in engine and jobbing foundry. Will go anywhere South or West. Good reasons given for changing, and reference as to management, economical melting and industry. "Foundry Economy," care Am. Machinist.

Wanted—A man capable of superintending construction of portable and stationary engines and boilers Must be a good draughtsman and capable of estimating on work; thoroughly competent, and of sober habits. To such a man, will give a permanent situation. Address, giving references, "Superintendent," care Am. Machinist.

Wanted—A second-hand 60 or 70 lbs. Bradley Hammer. Address, giving full particulars as to its condition and price, "Hammer," Am. Machinist.

Wanted—A good second-hand iron planer, to plane 62 inches wide, 10 feet long; height immaterial. Address "Planer," office of the Am. Machinist.

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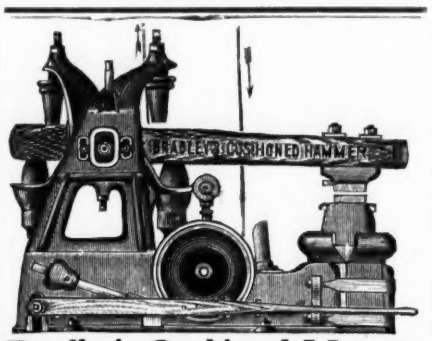

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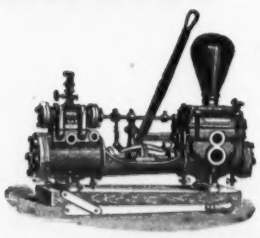

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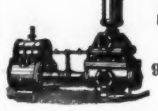

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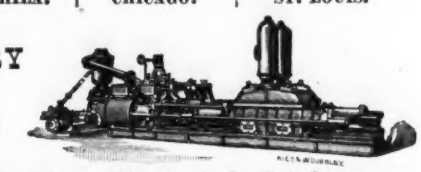

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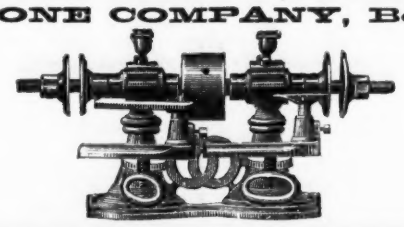

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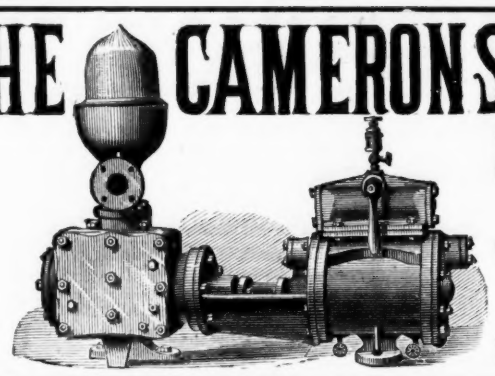

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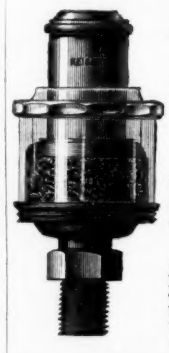

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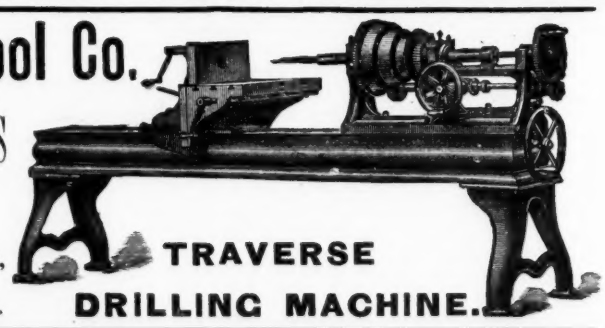

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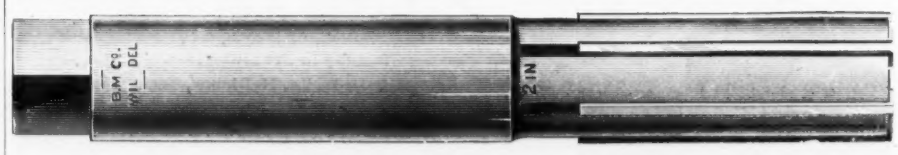

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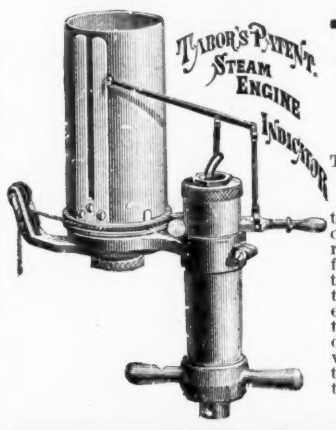

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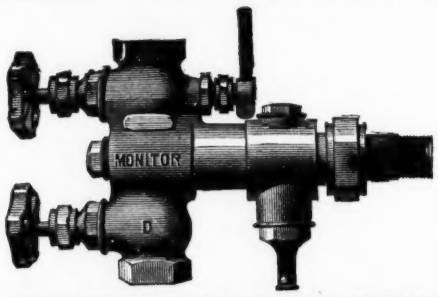

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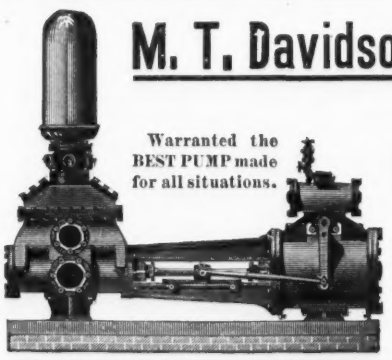

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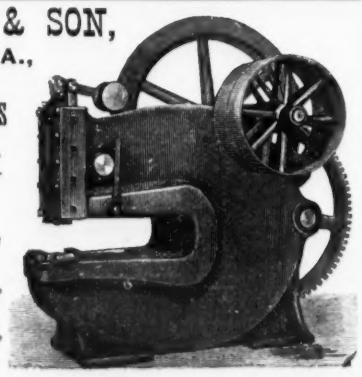

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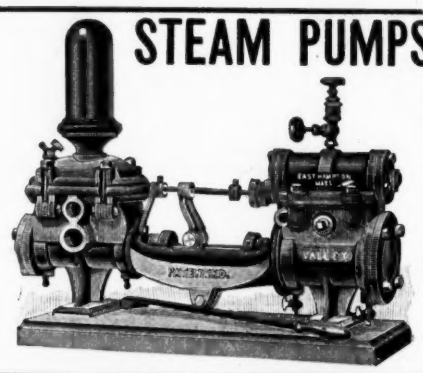

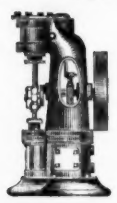

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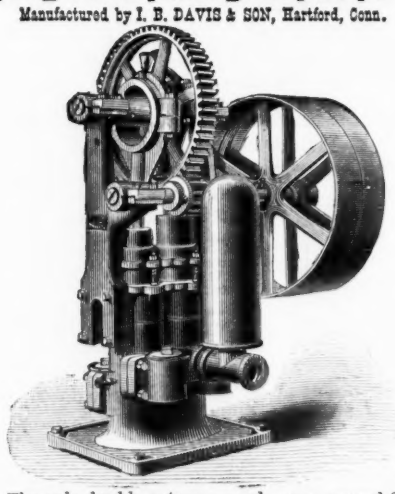

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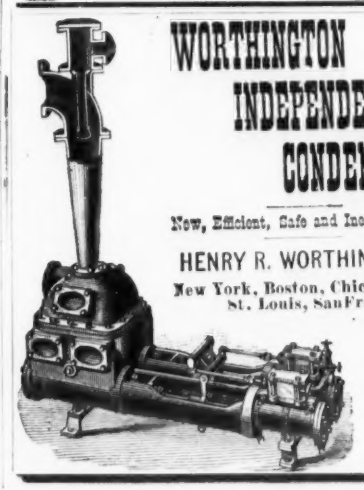

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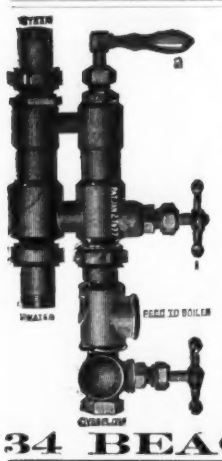

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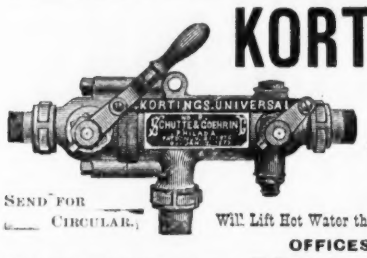

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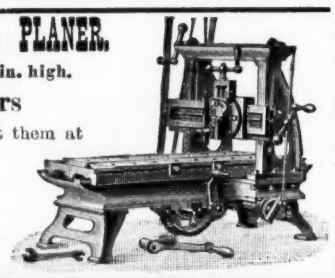

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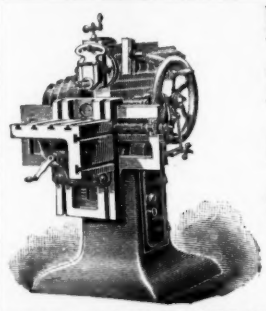

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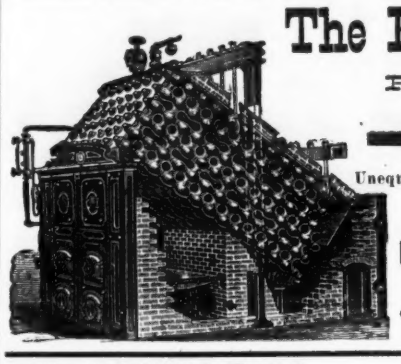

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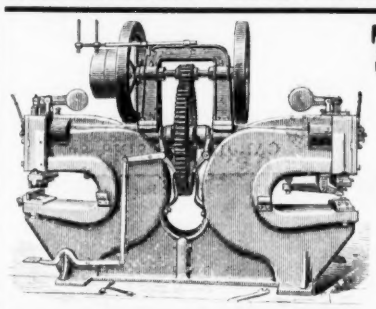

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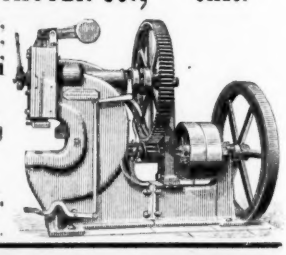

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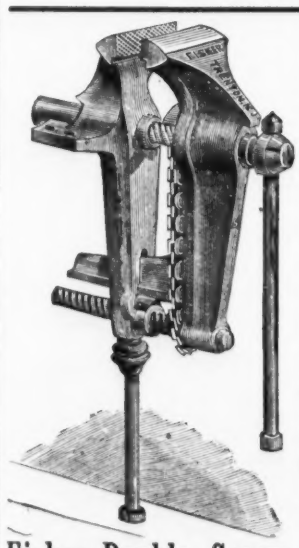

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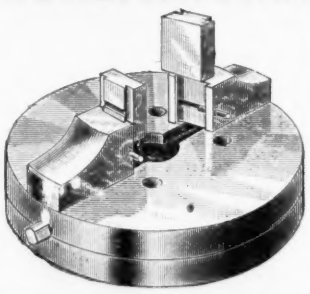

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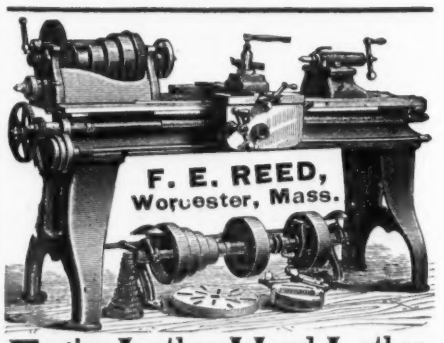

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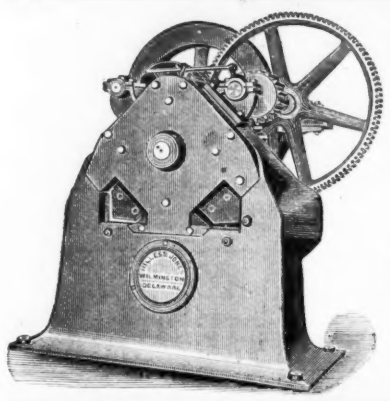

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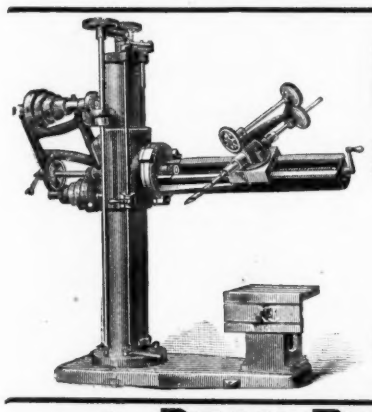

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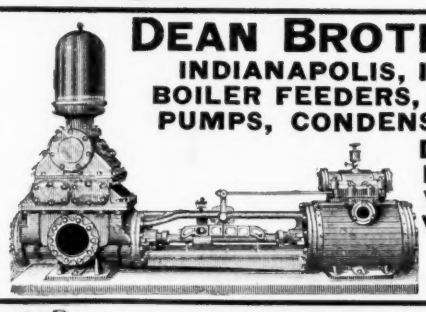

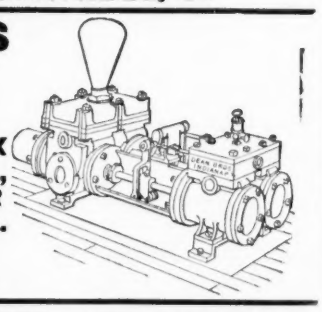

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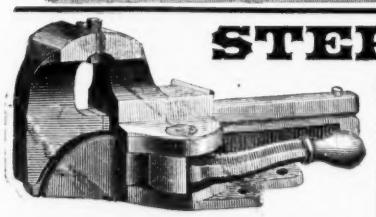

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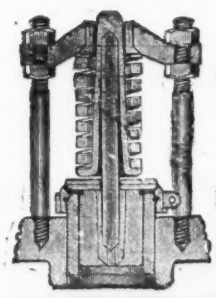

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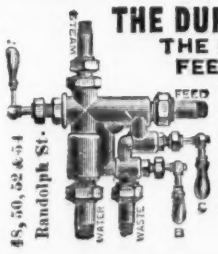

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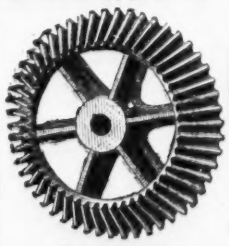

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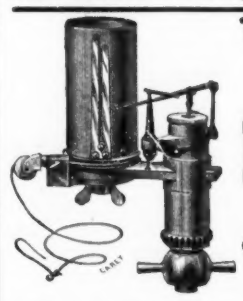

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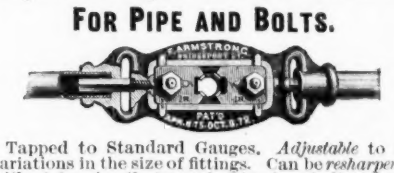

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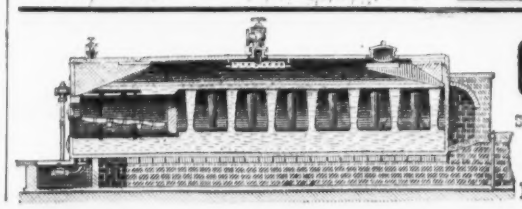

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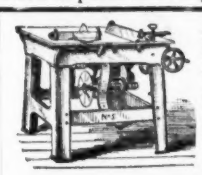

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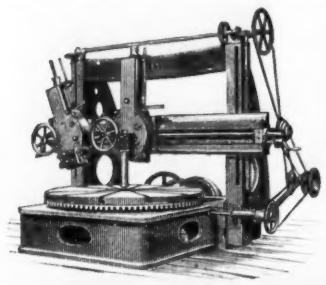

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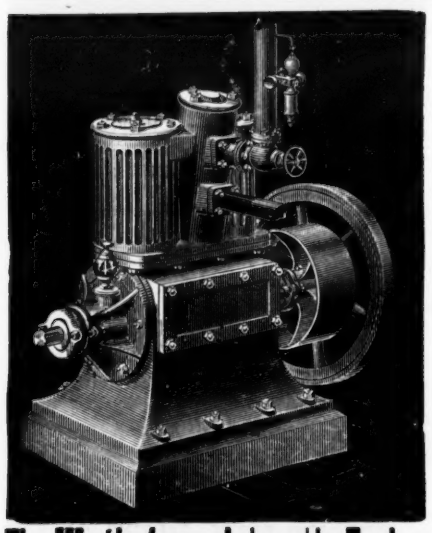

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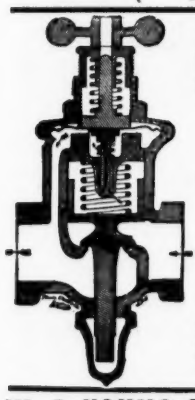

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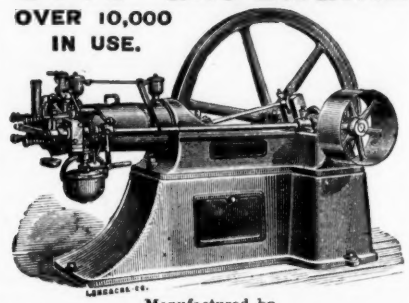

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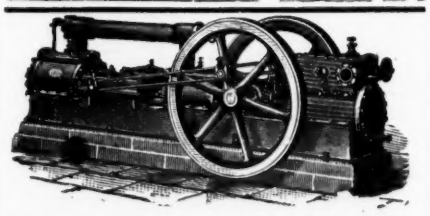

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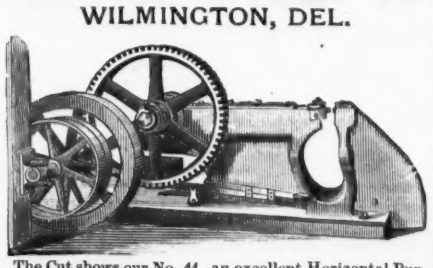

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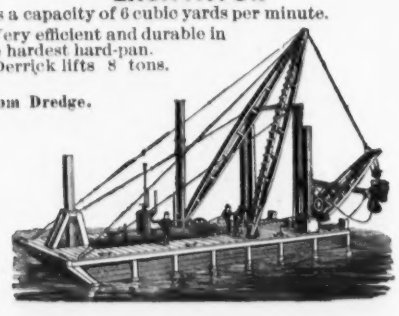

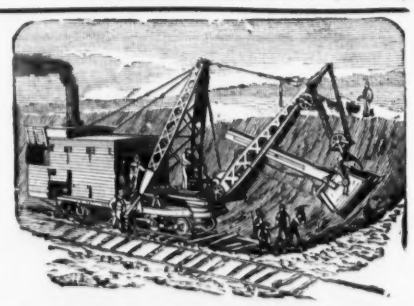

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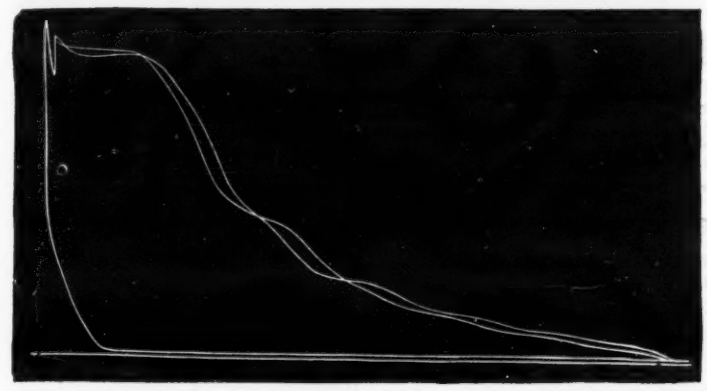

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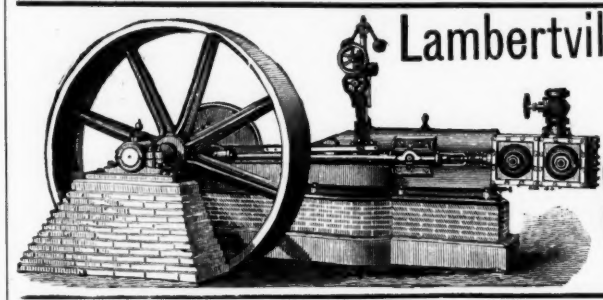

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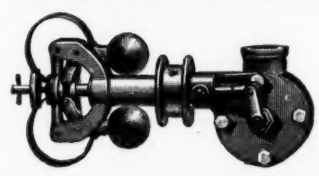

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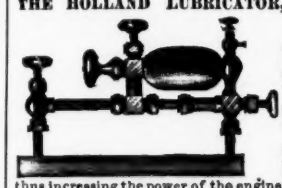

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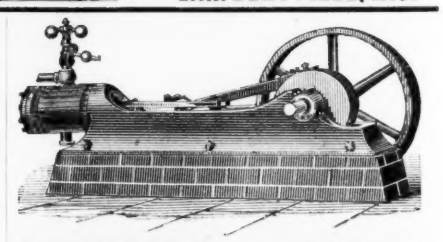

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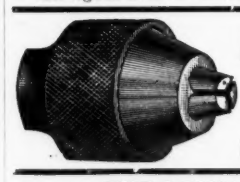

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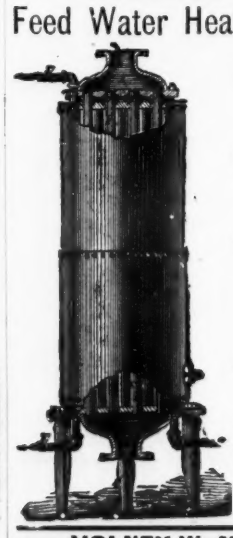

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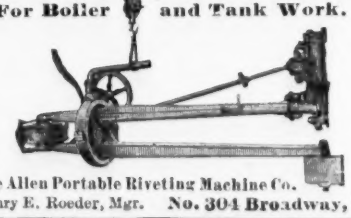

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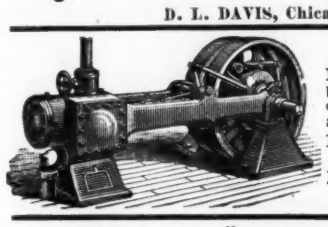

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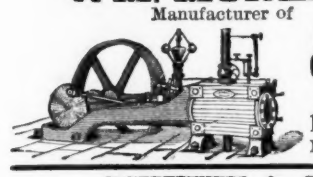

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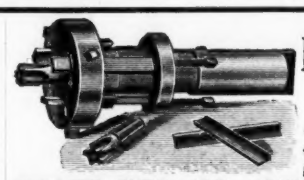

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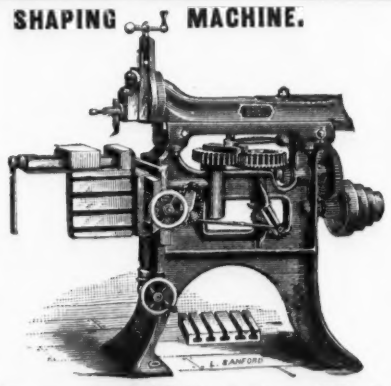

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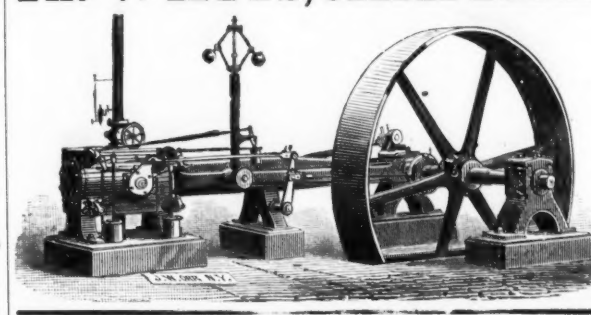

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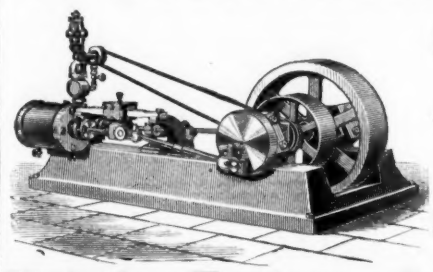

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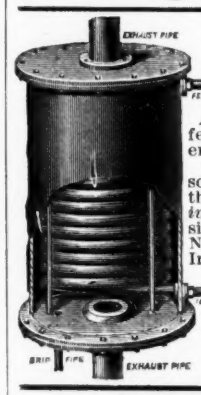

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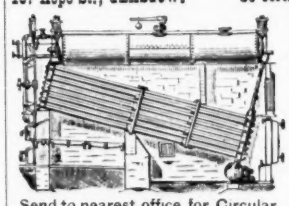

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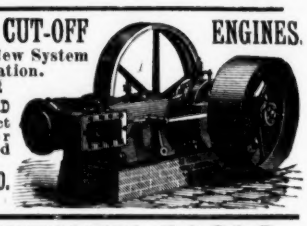

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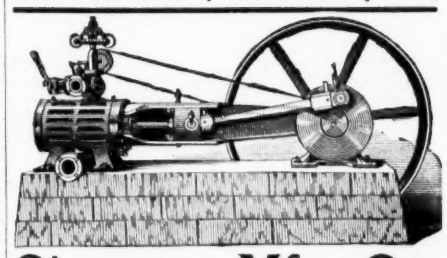

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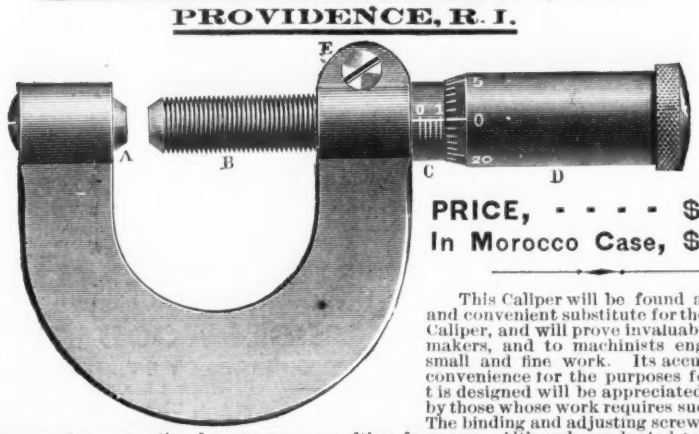

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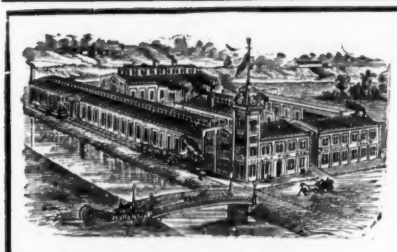

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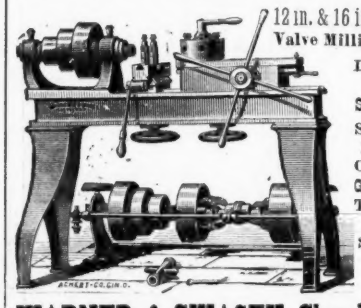

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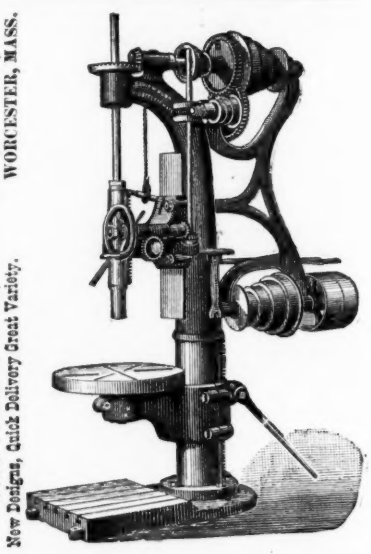

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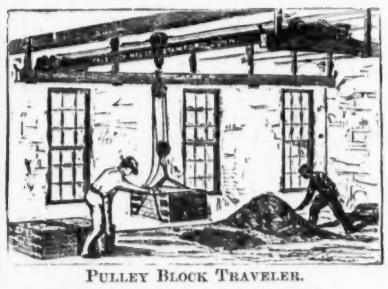

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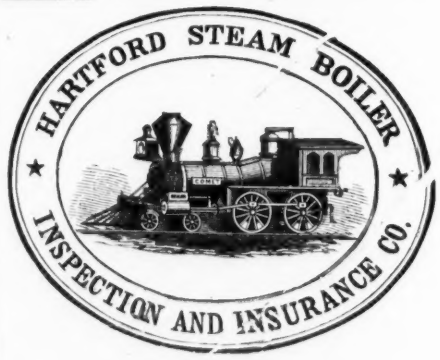

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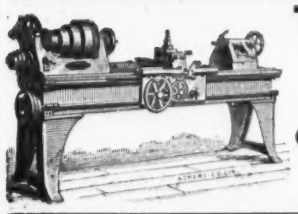

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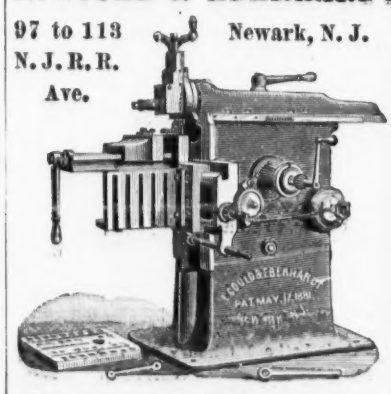

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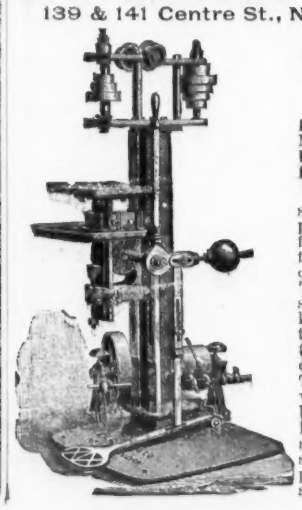

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